Course Curriculum (in light of NEP 2020) for B. Tech.

In

Civil Engineering

(For students admitted in 2023-24 onwards)

National Institute of Technology
Arunachal Pradesh

P.O.: Jote, Dist.: Papumpare, Arunachal Pradesh,
Pin–791113
www.nitap.ac.in

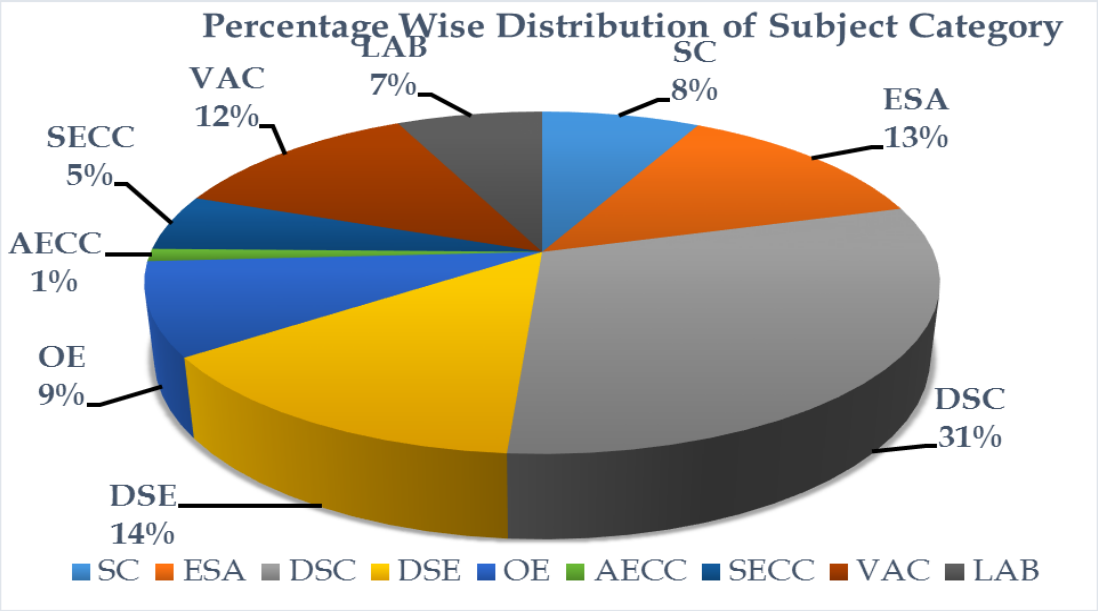
1.0 Semester wise Credit point distribution

Sl. No.	Year	Credit Point	
		ODD	EVEN
1	First	22	22
2	Second	21	21
3	Third	24	23
4	Fourth	20	17
Total Credit Point		**87**	**83**
		170	

1.1 Subject Category wise Credit point Distribution

Course Category	Sem - I	Sem - II	Sem - III	Sem - IV	Sem - V	Sem- VI	Sem- VII	Sem- VIII	Total Credit Point
Science Core (SC)	7	3	3	0	0	0	0	0	13
Engineering Science and Arts (ESA)	8	14	0	0	0	0	0	0	22
Departmental Specific Core (DSC)	4	3	9	9	9	9	3	0	46
Departmental Specific Elective (DSE)	0	0	3	3	3	6	9	6	30
Open Elective (OE)	0	0	3	3	3	3	3	0	15
Ability Enhancement Compulsory Course (AECC)	0	0	0	0	1	0	1	0	2
Skill Enhancement Compulsory Course (SECC)	3	0	0	3	3	0	0	0	9
Value Added Course (VAC)	0	2	0	0	2	2	4	11	21
Laboratory (LAB)	0	0	3	3	3	3	0	0	12
Total Credit Point	22	22	21	21	24	23	20	17	**170**

1.2 Subject Category wise Credit point Distribution (in percentage)



2.0 Course Structure

Semester - I						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS-1101	SC1 - Engineering Mathematics-I	2	0	0	2
2	BS-1102	SC2 - Engineering Chemistry	2	0	0	2
3	BS-1103	SC3 - Engineering Physics	2	0	0	2
4	BT-1101	ESA1 - Biology for Engineers	2	0	0	2
5	CE-1101	DSC1 - Building Planning, Construction Technology and Material	3	0	0	3
6	MH-1101	SECC1 - Communication Skill	2	0	0	2
7	EE-1102	ESA2 - Basic of Electrical and Electronics Engineering	2	0	0	2
8	CS-1102	ESA3 - Coding Laboratory	0	0	4	2
9	EE-1103	ESA4 - Basic of Electrical and Electronics Engineering Laboratory	0	0	2	1
10	BS-1104	SC4 - Engineering Physics Laboratory	0	0	2	1
11	ME-1102	ESA5 - Engineering Drawing	0	0	2	1
12	CE-1102	DSC2 - Building Material Testing Laboratory	0	0	2	1
13	MH-1102	SECC2 - Language Laboratory	0	0	2	1
14	MH-1103	VAC1 - NSS/NCC/Yoga (Audit Pass)	0	0	0	0
Contact Hours			15	0	14	
Total Credits						**22**

Semester - II						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS-1201	SC5 - Engineering Mathematics-II	2	0	0	2
2	CS-1201	ESA6 - Programming and Data Structure	3	0	0	3
3	EC-1201	ESA7 - Introduction to Digital Engineering	2	0	0	2
4	MH-1201	ESA8 - Introduction to Innovation and Creativity	2	0	0	2
5	ME-1201	ESA9 - Engineering Mechanics	3	0	0	3
6	CE-1201	DSC3 - Surveying - I	3	0	0	3
7	CE-1202	ESA10 - System Design	2	0	0	2
8	ME-1204	ESA11 - Workshop Practice-I	0	0	2	1
9	CE-1203	VAC2 - Do It Yourself (DIY)/Industry Exposure	0	0	0	1
10	BS-1202	SC6 - Engineering Chemistry Laboratory	0	0	2	1
11	CS-1204	ESA12 - Programming and Data Structure Laboratory	0	0	2	1
12	MH-1202	VAC3 - Gandhian Philosophy and Technology	0	0	2	1
Contact Hours			17	0	8	
Total Credits						**22**
Semester - III						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS-2101	SC7 - Engineering Mathematics-III	3	0	0	3
2	CE-2101	DSC4 - Mechanics of Solids	3	0	0	3
3	CE-2102	DSC5 - Fluid Mechanics - I	3	0	0	3
4	CE-2103	DSC6 - Transportation Engineering - I	3	0	0	3
5	CE-210A / CE210B	DSE1 - Engineering Geology / DSE1 - Remote Sensing and GIS	3	0	0	3
6	CE-210X	OE1*	3	0	0	3
7	CE-2104	LAB1 - Surveying Laboratory - I	0	0	2	1
8	CE-2105	LAB2 - Fluid Mechanics Laboratory - I	0	0	2	1
9	CE-2106	LAB3 - Structural Mechanics Laboratory	0	0	2	1
Contact Hours			18	0	6	
Total Credits						**21**
Semester - IV						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-2201	DSC7 - Structural Analysis - I	3	0	0	3
2	CE-2202	DSC8 - Environmental Engineering - I	3	0	0	3
3	CE-2203	DSC9 - Surveying - II	3	0	0	3
4	CE-220A / CE220B	DSE2 - Fluid Mechanics – II / DSE2 - Computational Fluid Dynamics	3	0	0	3
5	CE-220X	OE2*	3	0	0	3
6	MH-2201	SECC3 - Entrepreneur Essential and Early-Stage Start-up	3	0	0	3

7	CE-2204	LAB4 - Transportation Engineering Laboratory - I	0	0	2	1
8	CE-2205	LAB5 - Surveying Laboratory - II	0	0	2	1
9	CE-2206	LAB6 - Structural Engineering Laboratory	0	0	2	1
Contact Hours			18	0	6	
Total Credits						**21**
Semester - V						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-3101	DSC10 - Design of RCC Structures - I	3	0	0	3
2	CE-3102	DSC11 - Geotechnical Engineering - I	3	0	0	3
3	CE-3103	DSC12 - Concrete Technology	3	0	0	3
4	CE-310A / CE310B	DSE3 - Railway, Airport and Harbour / DSE3 - Traffic Engineering	3	0	0	3
5	CE-310X	OE3*	3	0	0	3
6	CE-3104	AECC1 - Internship-I	0	0	0	1
7	MH-3101	SECC4 - Engineering Economics	3	0	0	3
8	CE-3105	VAC4 - Minor Project-I	0	0	4	2
9	CE-3106	LAB7 - Geotechnical Engineering Laboratory - I	0	0	2	1
10	CE-3107	LAB8 - Concrete Technology Laboratory	0	0	2	1
11	CE-3108	LAB9 - Environmental Engineering Laboratory - I	0	0	2	1
Contact Hours			18	0	10	
Total Credits						**24**
Semester - VI						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-3201	DSC13 - Engineering Hydrology	3	0	0	3
2	CE-3202	DSC14 - Design of Steel Structures - I	3	0	0	3
3	CE-3203	DSC15 - Geotechnical Engineering - II	3	0	0	3
4	CE-320A / CE-320B /	DSE4 - Sustainable Construction and Green Manufacturing DSE4 - Design of RCC Structures - II	3	0	0	3
5	CE-321A / CE-321B	DSE5 - Environmental Engineering – II / DSE5 - Environmental Systems Design and Modelling	3	0	0	3
6	CE-320X	OE4*	3	0	0	3
7	CE-3204	VAC5 - Minor Project-II	0	0	4	2
8	CE-3205	LAB10 - Computer Applications in Civil Engineering	0	0	2	1
9	CE-3206	LAB11 - Civil Engineering Drawing	0	0	2	1
10	CE-3207	LAB12 - Geotechnical Engineering Laboratory - II	0	0	2	1
Contact Hours			18	0	10	
Total Credits						**23**
Semester - VII						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**

1	CE-4101	DSC16 - Civil Engineering Construction and Development	3	0	0	3
2	CE-410A / CE-410B	DSE6 - Structural Analysis-II/ DSE6 - Disaster Management	3	0	0	3
3	CE-411A / CE-411B	DSE7 - Estimation, Contract and Valuation / DSE7 - Design of Steel Structures - II	3	0	0	3
4	CE-412A / CE-412B / CE-412C	DSE8 - Irrigation and Hydraulic Structures / DSE8 - Ground Water Engineering / DSE8 - River Engineering	3	0	0	3
5	CE-410X	OE5*	3	0	0	3
6	CE-4102	AECC2 - Internship-II	0	0	0	1
7	CE-4103	VAC6 - Major Project-I	0	0	8	4
Contact Hours			15	0	8	
Total Credits						**20**
Semester - VIII						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-421A / CE-421B / CE-421C	DSE9 - Environmental Impact Assessment / DSE9 - Solid and Hazardous Waste Management/ DSE9 – SWAYAM Course	3	0	0	3
2	CE-422A / CE-422B / CE-422C / CE-422D	DSE10 - Pre-stressed Concrete Structures / DSE10 - Earthquake Resistant Structures / DSE10 - Advanced Foundation Engineering/ DSE10 – SWAYAM Course	3	0	0	3
3	CE-4201	VAC7 - Major Project-II	0	0	22	11
Contact Hours			6	0	22	
Total Credits						**17**

*The students have to choose a subject offered by another department

3.0 List of Department specific electives

Numbers	Course Title
DSE1	Engineering Geology
	Remote Sensing and GIS
DSE2	Fluid Mechanics – II
	Computational Fluid Dynamics
DSE3	Railway, Airport and Harbour
	Traffic Engineering
DSE4	Structural Analysis – II
	Design of RCC Structures - II

DSE4	Environmental Engineering – II
	Environmental Systems Design and Modelling
DSE6	Sustainable Construction and Green Manufacturing
	Disaster Management
DSE7	Estimation, Contract and Valuation
	Design of Steel Structures - II
DSE8	Irrigation and Hydraulic Structures
	Ground Water Engineering
	River Engineering
DSE9	Environmental Impact Assessment
	Solid and Hazardous Waste Management
	SWAYAM Course
DSE10	Pre-stressed Concrete Structures
	Earthquake Resistant Structures
	Advanced Foundation Engineering
	SWAYAM Course

- **Students are urged to register for the electives given under DSE9 and DSE10 using the SWAYAM/NPTEL, etc. portal. Courses will be of completely student's choice and should be of at least of 12 weeks including tutorials which will be considered as 3 credit courses.**

4.0 Open elective (offered by other departments)

- ❖ Students are free to choose any subjects of their interest offered as open electives by other department of the Institute.
- ❖ The total course has to be of 15 credits.
- ❖ During the beginning of the 3rd semester onwards, HoD of Civil Engineering will notify the specific subject offered as an open elective for other departments.

Open Electives (Offered by CE Dept. for other Departmental Students)

Sl No	Course Code	Course Title	L	T	P	C
1	CE-210X	OE1 - Environmental Science and Engineering	3	0	0	3
2	CE-220X	OE2 - Soil Mechanics and Foundation Engineering	3	0	0	3
3	CE-310X	OE3 - Structural System and Analysis	3	0	0	3
4	CE-320X	OE4 - Water Resources Engineering	3	0	0	3
5	CE-410X	OE5 - Transportation Engineering	3	0	0	3
Contact Hours			15	0	0	
Total Credits						**15**

5.0 Internship

- Internship - I: Student will go for internship during summer vacation (after 4th semester) for a period of 4 weeks. The assessment will be done on 5th semester
- Internship - II: Student will go for internship during summer vacation (after 6th semester) for a period of 4 weeks. The assessment will be done on 7th semester

6.0 Institute Vision

To transform into an acclaimed institution of higher learning with creation of an impact on the Nort-Eastern region in terms of innovation and entrepreneurship.

7.0 Institute Mission

1. To generate new knowledge through state-of-the-art academic program and research in multidisciplinary field.
2. To identify regional, Indian, and global need to serve the society better.
3. To create an ambience to flourish new ideas, research, and academic excellence to produce new leaders and innovators.
4. To collaborate with other academic, research institutes and industries for holistic growth of the students.
5. Utilization of available big resources to encourage entrepreneurship through formation of start-ups.

8.0 Departmental Vision

Committed to produce outstanding professional engineers to serve society with leadership and **entrepreneurship skills,** with focus on interdisciplinary and innovative ideas and high-end research to compete at the global level with special emphasis commensurate to North-Eastern region.

9.0 Departmental Mission

1. To impart skill development courses that add value to student competencies inside and outside the classroom.
2. To promote quality education in a congenial environment and inculcate moral and ethical values among the students.
3. To create a platform for the students to collaborate with other academic, research institutes, and industries for their overall development.

10.0 Programme Outcomes (POs)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Identify, formulate, review research literature, and analyse** complex engineering

	problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team-work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

11.0 Program Educational Objectives (PEOs)

PEO1	Graduates of the programme will provide an economical and sustainable solutions for the infrastructure.
PEO2	Graduates of the programme will be developed to be an individual entrepreneurship with leadership skills.
PEO3	Graduates of the programme will have a potential to upskill and adopt modern technologies.

12.0 Program Specific Outcomes (PSOs)

PSO1	An ability to identify, articulate and solve complex engineering problems by applying principles of engineering and modern techniques.
PSO2	Able to pursue lifelong learning, professional development, and entrepreneurship skills to face the developing needs of the society.
PSO3	An ability to apply concepts of engineering design and management tools in global, economic, environmental, and societal contexts.

Semester - I						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS-1101	Engineering Mathematics-I	2	0	0	2
2	BS-1102	Engineering Chemistry	2	0	0	2
3	BS-1103	Engineering Physics	2	0	0	2
4	BT-1101	Biology for Engineers	2	0	0	2
5	CE-1101	Building Planning, Construction Technology and Material	3	0	0	3
6	MH-1101	Communication Skill	2	0	0	2
7	EE-1102	Basic of Electrical and Electronics Engineering	2	0	0	2
8	CS-1102	Coding Laboratory	0	0	4	2
9	EE-1103	Basic of Electrical and Electronics Engineering Laboratory	0	0	2	1
10	BS-1104	Engineering Physics Laboratory	0	0	2	1
11	ME-1102	Engineering Drawing	0	0	2	1
12	CE-1102	Building Material Testing Laboratory	0	0	2	1
13	MH-1102	Language Laboratory	0	0	2	1
14	MH-1103	NSS/NCC/Yoga (Audit Pass)	0	0	0	0
Contact Hours			15	0	14	
Total Credits						**22**

Subject Code: BS-1101
Subject Name: Engineering Mathematics – I
Credit Point: 2 **(**P=0, T=0, L=2)

A. Course Objectives:

The course is designed to meet with the objectives of:

1. Providing high quality education in pure and applied mathematics in order to prepare students for graduate studies or professional careers in mathematical sciences and related fields,
2. Imparting theoretical knowledge and to develop computing skill to the students in the area of Science and Technology,
3. Providing teaching and learning to make the students competent to their calculating ability, logical ability and decision-making ability,
4. Giving students theoretical knowledge of Calculus, Algebra and the practical applications in the various fields of Science and Engineering,
5. Apply their knowledge in modern industry or teaching, or secure acceptance in high-quality graduate program in Mathematics and other fields such as the field of quantitative /Mathematical finance, Mathematical computing, statistics and actuarial science.

B. Course Content:

Matrix Algebra: Basic concept of matrices & Determinant, Jacobi's theorem. Rank of a matrix, rank nullity theorem, Introduction to Vector space, Linear dependent and independent, System of homogeneous and non-homogeneous linear equations, Eigen values and Eigen vectors of a square matrix, Cayley-Hamilton theorem and its applications.

Differential Calculus: Higher order derivatives, Leibnitz's theorem and its application, Rolle's theorem and its application, Mean Value theorems–Lagrange & Cauchy and their application, Taylor's theorem and its application, Expansions of functions by Taylor's and Maclaurin's theorem. Partial Derivatives, Differential calculus for two variables.

Integral Calculus: Double and triple integrals and evaluation of area and volume, change of variables.

C. Text Books

1. Kreyszig E., Advanced Engineering Mathematics, John Wiley, 2010, 11th edition.
2. Grewal B. S., Higher Engineering Mathematics, Khanna Publishers, 2014, 43rd edition.
3. Marsden J., Tromba A. J. and Weinstein A., Basic Multivariable Calculus, Springer, India, Private Ltd, 2009.

D. Reference Books

1. Finney R. L. and Thomas G. B., Calculus and Analytical Geometry (Linear Algebra), Narosa Publishing House, 2021, 9th edition.
2. Hofmann K. M. and Kunze R., Linear Algebra, Prenticehall, 2015, 2ndedition,.
3. Bartle and Sherbart, Introduction to Real Analysis, Wiley, 2014, 4thedition.
4. Apostol T. M., Calculus,Vol I and II, John Wiley and Sons Ltd;, 2007, 2nd edition.
5. Stewart J., Transcendental Calculus, Cengage; 2014, 2nd edition,.
6. Mappa S. K., Higher Algebra, Shrat book House, 2014.
7. Mappa S. K., Real Analysis, Shrat book House, 2013, 7th edition.
8. Wylie C. R. and Barrett L. C., Advanced Engineering Mathematics, McGraw Hill, 1995.

E. Course Outcomes:

The outcomes of course are following:

1. Students will become more confident about their computing skill, logical skill and decision-making skill,
2. Students will find various applications of calculus and algebra in the practical fields of science and engineering,
3. Students will become more competent to analyze mathematical and statistical problems, precisely define the key terms, and draw clear and reasonable conclusions,

4. Student will be able to explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results

Subject Code: BS-1102
Subject Name: Engineering Chemistry
Credit Point: 2 **(**L=2, T=0, P=0)

A. Course Objectives:

1. To enable the students to acquire knowledge about basic chemistry and its technology.
2. To understand applicability of chemistry for engineering purposes.
3. To make them apply the knowledge of chemistry for analysis, evaluation and design system components or processes related to chemistry.

B. Course Content

Chemical thermo dynamics: first law, energy, enthalpy, Cp and Cv, second law, entropy, free energy, chemical kinetics: rate of elementary reactions, surface chemistry: surfactants and colloidal systems; electrochemistry: conductance, Kohlrausch's law, cell EMF.

Ligand, isomerism, valence bond theory, valence shell electron pair repulsion theory, crystal field theory, molecular orbital theory, charge transfer transition, d-d transition, John-Teller effect, magnetic properties, bioinorganic chemistry.

Hybridization, inductive effect, resonance, hyper conjugation, carbocation, carbanion and free radicals, substitution and addition reactions, introduction to instrumental methods (IR, UV-vis, NMR and Mass-spectroscopy).

Polymers and materials: addition and condensation polymers, degree of polymerization, thermoplastic and thermosetting plastics, conducting polymers, nanomaterial's and ceramics, nan composites, corrosion, explosive materials.

C. Text Books:

1. Morrison R. T., Boyd R. N. and Bhattacharjee S. K., Organic chemistry, Pearson education, New Delhi, 2010, 7th Ed.,.
2. Rakshit P.C., Physical chemistry, Sarat book distributors, Kolkata, 2004, 7th Ed.
3. Huheey J. E., Keiter E. A., Keiter R. L., Inorganic chemistry: principles of structure and reactivity, Pearson Education, New Delhi, 2009, 4th Ed..

D. Reference Books:

1. Ray B. C., Das S. N. and Biswas S., Engineering chemistry, New Central Book Agency, Kolkata, 2008.

2. Gowariker V. R, Viswanathan N. V and Sreedhar J., Polymer science, New Agency International, Kolkata, 2012.
3. Malik W. U., Tuli G. D. and Madan R. D., Selected topics in inorganic chemistry, S. Chand, New Delhi, 2012.

E. Course Outcomes:

After studying this course, students will be able to

1) Acquire basic knowledge in engineering chemistry.
2) Apply their knowledge for various technological and engineering issues.
3) Select appropriate analysis, evaluation and methods for interpret the concern results.

Subject Code: BS-1103
Subject Name: Engineering Physics
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

The course is designed to meet with the objectives of:

1. Imparting theoretical & practical knowledge to the students in the area of engineering physics.
2. Providing teaching and learning to make students acquainting with modern state-of-art of Engineering.
3. Injecting the future scope and the research direction in the field of Physics with specific specialization.
4. Making students competent to design & development of Engineering Physics.

B. Course Content:

Electricity and Magnetism:

Coulombs law in vector form, Electric field, Gauss's law (differential and integral form), Electric potential and energy, multipole expansion of electric potential, Boundary value problem (Poisson's Eqn. and Laplace's Eqn.). Dielectric, Polarization and Bound charges, Biot-Savart's law, Ampere's law (differential and integral form), Faraday's law of electromagnetic induction, Lenz's Law, Self and mutual Inductance, Maxwell's field equation in vacuum and matter. Wave solution of Electromagnetic waves.

Modern Physics and Quantum Mechanics:

Photo electric effect, Compton effect, Blackbody radiation (no derivations), Wave particle duality, two slit experiments, de-Broglie's hypothesis, Heisenberg's uncertainty principle, concept of wave function and wave packet**,** phase velocity and group velocity, Formulation of quantum mechanics and basic postulates, physical interpretation of wave

function, Schrodinger's wave equation, Steady state of Schrodinger's wave equation, One dimensional quantum problems: Free particle, particle in a box, particle in a step potential, harmonic oscillator.

C. Text Books:

1. Griffiths J. D, "Introduction to Electrodynamics," Pearson Education India Learning Private Limited, 2015, 4th edition.
2. Griffiths J. D, "Introduction to Quantum Mechanics," Pearson Education, 2015, 2nd edition,.
3. Beise, A., Mahajan, S. and Choudhury S. R., "Concepts of Modern Physics," McGraw-Hill Education, 2017, 7th edition.

D. Reference Books:

1. Krane K., "Modern Physics", Wiley, 2016.
2. Jackson, J. D. "Classical Electrodynamics", Wiley, 1998, 3rd edition.
3. Feynman R. P., Leighton R. B. and Matthew S., "The Feynman Lectures on Physics Vol. 1 to Vol. 3" The New Millennium Edition, 2012.

E. Course Outcomes:

Students successfully completing this module will be able to:

1. Demonstrate competency and understanding of the basic concepts found in physics.
2. Utilize the scientific method for formal investigation and to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.
3. Engineering applications capability to understand advanced topics in engineering. apply quantum mechanics to engineering phenomena
4. Identify formula and solve engineering problems.

Subject Code: BT-1101
Subject Name: Biology for Engineers
Credit Point: 2 **(**L=2, T=0, P=0)

A. Course Objectives:

1. Imparting knowledge on the origin of Earth and life forms on Earth, appreciating importance of biological diversity and understanding biomolecules being the main component of life.
2. Understanding "Cell" – the basic UNIT in different life forms, and structure and function of different organelles in living organisms
3. Imparting knowledge on nutrient uptake and assimilation, and metabolism in living

organisms, providing knowledge on Bioenergetics of living cells, different organelles involved in electron transport systems, nervous, digestive and immune systems in animals.

4. Imparting knowledge on immunity of the body and various advanced applications derived out of the natural systems
5. Imparting knowledge on DNA as a genetic material and various advanced technology derived out of it for variety of applications
6. Imparting knowledge on interference of biological systems in various machines, structures, process and instrumentation
7. Motivating young minds to utilise their interdisciplinary knowledge to become a thinker in innovation of effective ideas for solving problems related to biological systems

B. Course Content:

Origin of Life: theories of origin of life, Classification of various forms of life (virus, bacteria, fungi, plantae, Animalia). **Nutrients and Bioenergetics:** Essential nutrients (carbohydrates proteins, lipids, nucleic acids, minerals, vitamins), Bioenergetics; basics of aerobic and anaerobic glycolysis and citric acid cycle. **Cell:** Cell concept, prokaryotic and eukaryotic cell, cell organelles and their functions, Cell division: Mitosis and meiosis, Cancer biology.**Immunology:** Immune systems and cell types, applications of immunology: biosensors, nanoparticles.**Genes and Chromosomes:** Principles of inheritance, Mendelian Genetics, Discovery of DNA as genetic material, DNA mutation and effects, Genetic engineering/Cloning and its applications

C. Text Books:

1. Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Kelsey C. Martin; Michael Yaffe; Angelika Amon. Molecular Cell Biology (Ninth Edition). W. H. Freeman, 2020.
2. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 8th Ed, W. H. Freeman & Co, 2015.
3. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, 7th Ed, Macmillan Worth, 2017.
4. N.A. Campbell, J.B. Reece, "Biology" Person Education, Inc& Dorling Kinderley Publishing, Inc, 2015
5. Wen, Judith A., Jenni Punt, and Sharon A. Stranford. Kuby immunology. New York, NY, USA:: WH Freeman, 2013.
6. Niemeyer, Christof M., and Chad A. Mirkin, eds. Nanobiotechnology: concepts, applications and perspectives. Vol. 1. John Wiley & Sons, 2004.

D. Reference Books:

1. Nruno Antonny, Catherine Rabouille. Cell Organlles, Current Opinion in Cell Biology, Elsevier, 2017
2. Joel B. Hagen. Five Kingdoms, More or Less: Robert Whittaker and the Broad Classification of Organisms, BioScience, Oxford Academic, 2012
3. Pascal Maguin,Luciano A. Marraffini, From the discovery of DNA to current tools for DNA editing, JEM, 2021

E. **Course Outcomes:**

1. Students will understand the characteristics of living organisms; appreciate the importance of diversity of life and their interaction with the environment.
2. Students will be able to explain the interrelationship between biomolecules and the living system, and influences of biomolecules upon the structure and function of intracellular components.
3. Students will have a broad knowledge on Bioenergetics of living cells; and a brief on important biological systems of animal.
4. Students will learn different functions of cell organelles, cell types and various positive and negative functional implications, development of new tools and kits from the knowledge of natural system.
5. Students will learn the basis of inheritance and introduction to technological aspects and varied applications and advanced tools to tackle medical complications
6. Students will learn the interference of biological systems in various machines, structures, process and instrumentation
7. Students will develop keen interest in applying basic engineering skills to solving problems related to biological systems through their concepts in biology

Subject Code: CE-1101
Subject Name: Building Planning, Construction Technology and Material
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Basic understanding of layout and planning of buildings along with building components.
2. Classify and characterize stones/rubble, bricks, glass etc.
3. Comprehend the manufacturing process of bricks, and cement.
4. Understand the use of non-conventional and indigenous Civil Engineering building materials such as mud/earth, adobe, ikra, bamboo, straw-bale etc

B. Course Content:

Functional Planning of Buildings: Planning Principles of Buildings, Orientation of Buildings, Built Environment, Functional Planning – Lighting, Heating, Ventilation, and

Climate factors, Building Service – Circulation, Plumbing, Electrification and Sanitation. Layouts-Residential, Auditorium, Cinema Hall, Studio.

Principle properties of building materials: Introduction, Physical properties of building materials, Mechanical Properties of building materials, Characteristic behavior of selected materials under stress

Cement: Introduction, Portland cement, Chemical composition of raw materials, composition of cement clinker, hydration, rate of hydration, manufacturing, physical characteristics, properties of cement compounds

Aggregate: Introduction, classification, characteristics, deleterious substances, soundness, thermal properties, fine aggregate, coarse aggregate, testing of aggregates, Influence of aggregate on the properties of concrete, aggregate selection

Masonry: Stone Masonry, Classification of stone masonry, Dressing of stones, safe permissible loads on stones, Brick masonry: Types of bricks, stretcher bond, header bond, English bond, Flemish bond etc. brick laying, tools for brick laying, bonds in-connections, brick piers, footings, defects in brick masonry, Tools for brick laying, strength of brick masonry, ornamental brick work, Composite masonry, brick-stone composite masonry

Walls: Load bearing Walls-Design considerations, lateral support, effective height of wall, Cavity walls-features, wall ties, construction of cavity walls, Partition walls-brick partition, clay block partition walls, concrete partition, glass partitions, wood slab partition etc.

Floors: Ground floor-Components of a floor, Materials for construction, selection of flooring materials mud flooring, brick flooring, cement concrete flooring, terrazzo flooring, mosaic flooring, tiled flooring ,timber flooring etc, Upper floor: steel joist and stone or precast concrete slab floors ,jack arch floors ,reinforced cement concrete floors

Lintels and arches: Classification of Lintels, timber lintels, stone lintels, reinforced cement concrete lintels, types of arch, stability of arch, classification of arch.

Stairs: Requirements of a good stairs, dimension of steps, classification of stairs.

Roof and Roof coverings: Types of roof- pitched roof, double or purlin roofs, trussed roofs, flat terraced roofing.

Doors and windows: Location of doors and windows, Size of doors, door frames, types of doors, windows, types of windows, ventilators.

Plastering and Pointing: Types of mortars for plastering, tools for plastering, Number of coats for plaster, Methods of plastering, defects in plastering

Painting, Distempering and Whitewashing: Characteristics of an ideal paint, constituents of a paint, classification and type of paints, defects in painting, Varnishing, Distempering, whitewash and colour washing

Damp proofing: Causes of dampness, effect of dampness, methods of damp proofing, materials used for damp proofing courses, D.P.C treatment in buildings.

Glass: Chemical compositions, mechanical and optical properties, various types of glasses, strengthening of glasses

C. Text Books:

1. Swamy N.K., Rao A.K., Building Planning and drawing, Charotor Publications, 2019.
2. Punmia B.C., Jain A. K., Building Construction, Laxmi Publications, 2019.
3. Duggal, S.K, Building Materials, New Age International (P) Limited Publishers, 2012.
4. Mamlouk M. S., Zaniewski J. P., Materials for Civil and Construction Engineers, Pearson Prentice Hall, 2006.

D. Reference Books:

1. Claisse P. A., Civil Engineering Materials, Elsevier, 2016.
2. Zhang H, Building Materials in Civil Engineering, Wood head Publishing Limited and Science Press., 2011.
3. Chitawadagi M.V., Bhavikatti. S.S., Building Planning and drawing, Dreamtech Press, 2019.

E. Course Outcomes:

1. Will be able to classify the bricks, stones, and cement types
2. Definition and nomenclature of the parts of a building structure will be clear
3. The functions and working of various components of building will be known
4. Selection and maintenance of the structural components of a building structure would be known to the students.

Subject Code: MH-1101
Subject Name: Communication Skill
Credit Point: 2 (L=2, T=0, P=0)

A. Course Objectives:

The course is designed to meet the following objectives:

1. To increase the student's ability to improve and utilize the skills necessary to be competent communicator.
2. To enhance the students' linguistic understanding of his or her own communication behaviour.
3. To improve the students' communication skills in both social and professional contexts.
4. To enhance language proficiency and thereby the employability of budding engineers and technologists.

B. Course Content:

Fundamentals of Communication-Concept and Meaning, Process of Communication, Communication Channels, Importance of Communication, Role of Cross-cultural Communication, Communication Cycle, Objectives and Barriers of Communication(linguistic and semantic, psychological, physical, mechanical, cultural),

Importance of Audience and Purpose, Types of Communication, Styles of Communication, Verbal and Nonverbal Communication, Comparing General Communication and Technical Communication, Role of Communication in Technology, Persuasive Skills, Negotiation Skills, Language Skills (listening, speaking, reading, writing),Listening-Types of Listening, Writing-Writing Formal Letters, Résumés, Reports, User Manuals, Emails and Blogs, Essentials of Grammar- Sentence Formation, Common Errors and Misappropriations, Note Making, Oral and Poster Presentation Skills, Interview Skills and Etiquette, Language Usage in Social Media.

C. Text Books:

1. Salaria, R.S. and Kul Bhushun Kumar, Effective Communication Skills, Khanna Publishing, 2022.
2. Edwards, Vanessa Van. Cues: Master the Secret Language of Charismatic Communication, Penguin, 2022.
3. Kumar, Sanjay and Pushp Lata, Communication Skills: Workbook, Oxford University Press (OUP), 2018.
4. Mitra, Barun K. Personality Development and Soft Skills, Oxford University Press(OUP), 2016.

D. Reference Books:

1. Kumar, Sanjay and Pushpa Lata, English Language and Communication Skills for Engineers (as per AICTE Syllabus), Oxford University Press (OUP), 2018.
2. Raman, Meenakshi and Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press (OUP), 2017.
3. Quirk, Randolph, Sidney Greenbaum, Geoffrey Leech, Jan Svartvik. A Comprehensive Grammar of the English Language, Pearson Education India, 2010.

E. Course Outcomes:

By the end of this course you will be able to:

1. Display competence in oral, written, and visual communication.
2. Apply communication theories in various speech acts.
3. Practice the effective way of communication with good personality traits and etiquette.
4. Understand the process of communication and its effect on giving and receiving information.

Subject Code: EE-1102
Subject Name: Basic of Electrical and Electronics Engineering
Credit Point: 2 **(**L=2, T=0, P=0)

A. Course Objectives:

1. To understand the structure and properties of different type of electrical circuits, networks and sources.
2. To apply different mathematical tools & techniques for analysing electrical networks.
3. To apply circuit analysis techniques to simplify electrical networks.
4. To solve problems of electrical circuits.

B. Course Content:

Network Theorems: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Superposition, Thevenin's, Norton's & Maximum power transfer theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.

Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits and Solution of problems.

AC Fundamentals: RMS Values, Average Values, Peak Factor, Crest Factor, Resonance. Power in purely resistive, inductive, capacitive, RL, RC and RLC Circuits.

Number Systems: Decimal, Binary, Octal, Hexadecimal systems, conversion of a number from one base to another, complements of number systems and its addition and subtraction, Introduction to logic gates.

Boolean Algebra: Theorems and operations, Boolean expressions and truth tables, Duality and inversion, multiplying out and factoring expressions, Exclusive-OR and equivalence operations, Positive and negative logic.

C. Text Books:

1. Theraja B. L., Theraja A.K., A Textbook of Electrical Technology Vol 1, Shree Hari Publications, 2021.
2. Morris Mano M., Digital Logic and Computer Design, Pearson Education India, First Edition, 2016.

D. Reference Books:

1. Kumar Anand, Fundamentals of Digital Circuits, Prentice Hall, 3rd Edition, 2014.
2. Salivahanan.S., Pravin Kumar.S., Digital Electronics, Vikas Publiashing House, First Edition, 2011.

E. Course Outcomes:

After completion of this course, the learners will be able to

1. Describe different type of networks, sources and signals with examples.
2. Explain different network theorems, coupled circuit and tools for solution of networks.
3. Apply network theorems and different tools to solve network problems.
4. Select suitable techniques of network analysis for efficient solution.
5. Estimate parameters of two-port networks.
6. Design filter circuits.

Subject Code: CS1102
Subject Name: Coding Laboratory
Credit Point: 2 **(**L=0, T=0, P=4)

A. Course Objectives:

1. The student will gain a thorough understanding of the fundamentals of C programming.
2. A student can code, compile and test C programs.
3. Could take Systems programming or Advanced C programming course.
4. Although this course does not deal with object-oriented programming methodology, it will assist the student build the required foundations to undertake a course in OOP.

B. Course Content:

Introduction: The von Neumann architecture, machine language, assembly language, high level programming languages, compiler, interpreter, loader, linker, text editors, operating systems, flowchart.

C Fundamentals: Introduction to C, Data types, Constants and variable declaration, Scope, Storage classes, Data input and output functions, Sample programs.

Operators & Expressions: Arithmetic, Relational, Logical, Bitwise operators, Conditional, Assignment, Library functions.

Decision making: Simple If statement, if-else statement, nested if else statement, Switch statement, nested switch, the operator, goto statement.

Decision making & branching: while statement, do-while statement, for statement.

Array: Declaration, Initialization and processing One-dimension array, Two-dimension array and multi dimension array and their operations.

String & pointer: String: Operation on String without using library function and using library function. Pointer: Declaration of pointer variables, accessing the variable by using pointer, pointer increment and decrement operator, pointer and array

Functions: Basic functions, function type, function with no argument & no return value,

function with no argument but return value, function with argument & return value, Storage class identifier, Call by reference, Recursive function. Pointer to function.

Structure & Union: Defining a structure, accessing of structure variable, structure and array, array within structure. Nested structure, structure & functions, Pointer & structure, Unions, Enum.

File management system: Advantage of using file, Open, close, read, write in the files, Operation on files.

Dynamic memory Allocation: use of malloc, calloc, realloc, free. Library functions, Implementation of Linked list and their various operations.

The pre-processor: macro statements.

C. Text Books:

1. Kerninghan and Ritchie, The 'C' programming language, 2nd Edition, Pearson, 2008.
2. Yashavant P. Kanetkar, Let Us C: Authentic guide to C programming language, 15th edition, BPB, 2021.
3. Balaguruswamy, Programming In ANSI C, 8th Edition, Tata McGraw-Hill Education, 2019

D. Reference Books:

1. Zed A. Shaw, Learn C the Hard Way: Pratical Exercises on Computational Subjects You Keep Avoiding (Like C), 2015.
2. Deepali Srivastava and S.K Srivastava, C in Depth, BPB Publication, 2017.
3. Griffiths David and Dawn Griffiths, Head First C, A Brain Friendly Guide, 2012.
4. Grey Perry and Dean Miller, C Programming Absolute Beginner's Guide, 3rd Edition, 2013.

E. Course Outcomes:

1. Understand the basic terminology used in computer programming.
2. Write, compile and debug programs in C language in different operating systems.
3. Design programs involving decision structures, loops and functions.
4. Use and apply the dynamics of memory by the use of pointers in engineering applications.
5. Use and apply the differences between structure oriented and function-oriented programming in programming applications.

Subject Code: EE-1103
Subject Name: Basic of Electrical and Electronics Engineering Laboratory
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. To understand the structure and properties of different type of electrical circuits, networks and sources.
2. To apply different mathematical tools & techniques for analysing electrical networks.
3. To apply circuit analysis techniques to simplify electrical networks.
4. To solve problems of electrical circuits.

B. List of Practical:

1. V-I Characteristics of Carbon and Tungsten filament lamp.
2. V-I Characteristics of Fluorescence Lamp.
3. V-I Characteristics of RLC Series Circuit.
4. V-I Characteristics of RLC Parallel Circuit.
5. Verification of truth tables of different logic and universal gates.
6. Implementation of logic gates with the help of universal gates.

C. Course Outcomes:

After completion of this course, the learners will be able to

1. Describe different type of networks, sources and signals with examples.
2. Explain different network theorems, coupled circuit and tools for solution of networks.
3. Apply network theorems and different tools to solve network problems.
4. Select suitable techniques of network analysis for efficient solution.
5. Estimate parameters of two-port networks.
6. Design of filter circuits.

Subject Code: BS-1104
Subject Name: Engineering Physics Laboratory
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

The course is designed to meet with the objectives of:

1. Imparting practical knowledge to the students in the area of engineering physics.
2. Student will have exposure to various experimental skills which is very essential for an engineering student.
3. To gain practical knowledge by applying the experimental methods to correlate with the physics theory.
4. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.
5. To learn the usage of various areas of physics like electricity and magnetism systems for various measurements.

B. List of Experiments:

1. Determination of Planck's constant using photocell.
2. Verification of Stefan's radiation law.
3. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
4. Verification of Biot-Savart's law.
5. Charging and discharging of capacitor using RC circuit
6. Hall Effect.
7. To determine e/m ratio.

C. Reference Books:

1. Arora C. L., "Practical Physics", S. Chand Publications, 2010.
2. Squires G. L., "Practical Physics", Cambridge University Press, 2014.

D. Course Outcomes:

Students successfully completing this module will be able to:

1. Apply the various procedures and techniques for the experiments.
2. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
3. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.

Subject Code: ME-1102
Subject Name: Engineering Drawing
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. Increase ability to understand Engineering Drawing.
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic Auto Cad skills.
5. Learn basic engineering drawing formats.
6. Prepare the student for future Engineering positions.

B. Course Content:

Indian standards: Sheet layout, type of lines and their representations, scales.
Principles of orthographic projection (multi view drawing): 1stand 3rd angle projection.

Projections: Points, lines, surfaces and solids.
Projection of sections and intersections of solids: Isometric projection.
Use of drafting software

C. Reference Books:

1. Dhananjay, A. J., "Engineering Drawing", TMH, 2017, 1st Ed.
2. Bhatt, N.D. and Panchal, V.M., "Engineering Drawing", Charotar Publishing House Pvt. Ltd, 2014, 43rd Ed.
3. Venugopal, K. and Prabhu,V. R., "Engineering Graphics", New Age International Pvt. Ltd, 2018, 15th Ed.

D. Course Outcomes:

1. Understand orthographic projections and sections.
2. Basic understanding of Indian standards of engineering drawing.
3. Develop engineering drawings by projection techniques.
4. Utilise AutoCAD towards developments of drawings.

Subject Code: CE-1102
Subject Name: Building Material Testing Laboratory
Credit Point: 1 (L=0, T=0, P=2)

A. Course Objectives:

1. To determine the properties of brick of different class
2. To test the physico-chemical properties of sand, cement, and aggregate
3. To find the working properties of cement, sand and aggregate

B. Course Content:

1. Laying and sketching of header and stretcher brick bonds
2. Laying and sketching of English and Flemish brick bonds
3. To determine the fineness and soundness of cement.
4. To determine the standard consistency of cement.
5. To determine the Initial and Final setting time cement.
6. Fineness modulus of coarse aggregate by sieve analysis.
7. Fineness modulus of fine aggregate by sieve analysis.
8. To determine the specific gravity of sand.
9. To determine the bulking of sand

C. Text Books:

1. Swamy N.K., Rao A.K., Building Planning and drawing, Charotor Publications, 2019.
2. Punmia B.C., Jain A. K., Building Construction, Laxmi Publications, 2019.
3. Duggal, S.K, Building Materials, New Age International (P) Limited Publishers, 2012.
4. Mamlouk M. S., Zaniewski J. P., Materials for Civil and Construction Engineers, Pearson Prentice Hall, 2006.

D. Reference Books:

1. Claisse P. A., Civil Engineering Materials, Elsevier, 2016.
2. Zhang H, Building Materials in Civil Engineering, Wood head Publishing Limited and Science Press., 2011
3. Chitawadagi M.V., Bhavikatti. S.S., Building Planning and drawing, Dreamtech Press, 2019.

E. Course Outcomes:

1. Know the various test and determine the associated properties related to building construction material.
2. Understanding the functions of various equipment used for testing of some common and specific building materials.
3. After conducting the test, assessing the usability of the materials as per the ranges of various parameters given by IS code.

Subject Code: MH-1102
Subject Name: Language Laboratory
Credit Point: 1 (L=0, T=0, P=2)

A. Course Objectives:

The course is designed to meet the following objectives:

1. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
2. To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
4. To improve the fluency of students in spoken English and neutralize their mother tongue influence
5. To train students to use language appropriately for public speaking and interviews.

B. Course Content:

Basics of Phonetics, Speech Sounds – Vowels and Consonants, Word Stress and Rhythm, Accent, Intonation, Phonetics Drills, Developing Effective Listening Skills- Listening Comprehension Drills, Speaking - Conversations, Dialogues, and Debates, Role Play, Situational Dialogues, Expressions in Various Situations, Making Requests and Seeking Permissions, Formal Presentations. Telephone Etiquette, Building Advanced Vocabulary and English Grammar Exercises.

C. Text Books:

1. Words worth English Language Software.
2. Kumar, Rajesh, English Language Communication Skills: Lab Manual Cum Workbook with CD, Cengage Learning India, 2014.

D. Reference Books:

1. Jones, Daniel. English Pronouncing Dictionary, Cambridge University Press, 2011.
2. Bansal, R. K. & J. B. Harrison. Spoken English with CD, Orient Black swan, 2013.

E. Course Outcomes:

By the end of this course, you will be able to:

1. Understand of nuances of English language through audio - visual experience and group activities.
2. Reach the neutral intelligibility.
3. Attain the clarity and confidence to enhance their employability skills.
4. Express themselves fluently and appropriately in social and professional contexts.

Semester - II						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BA-1201	Engineering Mathematics-II	2	0	0	2
2	CS-1201	Programming and Data Structure	3	0	0	3
3	EC-1201	Introduction to Digital Engineering	2	0	0	2
4	MH-1201	Introduction to Innovation and Creativity	2	0	0	2
5	ME-1201	Engineering Mechanics	3	0	0	3
6	CE-1201	Surveying - I	3	0	0	3
7	CE-1202	System Design	2	0	0	2
8	ME-1204	Workshop Practice-I	0	0	2	1
9	CE-1203	Do It Yourself (DIY)/Industry Exposure	0	0	0	1
10	BS-1202	Engineering Chemistry Laboratory	0	0	2	1
11	CS-1204	Programming and Data Structure Laboratory	0	0	2	1
12	MH-1202	Gandhian Philosophy and Technology	0	0	2	1
Contact Hours			17	0	8	
Total Credits						22

Subject Code: BS 1201
Subject Name: Engineering Mathematics - II
Credit Point: 2 **(**L=2, T=0, P=0)

A. Course objectives:

The course is designed to meet the following objectives:

1. Imparting theoretical knowledge to the students about three and more dimensional objects in space and to improve their capability of visualizing of objects in space.
2. Making student competent enough to construct a differential equation/mathematical modeling for every real life situation with its solution.
3. Giving students theoretical knowledge of vectors with the flavor of Calculus.
4. Introduce the concepts of Laplace and Fourier transforms and its application to the solution of differential equations (ODE &PDE) to the students.

B. Course Content:

Vector Calculus: Basics of vector calculus, Line integral, Surface integral and Volume integral, Path independence, Fundamental theorem of Calculus, Green's, Gauss' and Stokes' theorems (without proofs) and their simple applications.

Ordinary Differential Equations: First order ODEs, Higher order linear differential equation with constant coefficients, Euler's homogeneous equation, Series solutions of linear differential equations with variable coefficients (Ordinary point).

Partial Differential Equations: Basic of PDEs (order, degree, Linear, Non-Linear, homogeneous, non-homogeneous), Classification of 2nd Order PDEs; boundary and initial value problems (Dirichlet and Neumann type) involving wave equation, D'Alembert method, heat conduction equation, Laplace's equations and solutions by method of separation of variables (Cartesian coordinates).

C. Text Books:

1. Kreyszig E., Advanced Engineering Mathematics, John Wiley, 2010, 11thedition.
2. Ross S. L., Ordinary Differential Equation, Wiley and Sons Ltd., 2010, 3rd edition.
3. Farlow S. J., Partial Differential Equation for Scientists and Engineers, Dover Publications, 1993, 1st edition.

D. Reference Books:

1. Boyce and Diprima R. C., Elementary Differential Equations and Boundary value Problems, Wiley publications, 2009, 9th edition.
2. Sneddon I. N., Elements of Partial Differential Equations, Dover Publications Inc., 2013, 2ndedition.
3. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press,1stedition, 2001.
4. Earl Coddington, Norman Levinson, Introduction to Ordinary Differential Equations McGraw Hill Education; 1st edition, 2017.

E. Course Outcomes:

Upon completion of the subject:

1. Students will have strong visualizing capability in their mind about any object.
2. Students are so trained that they will recognize various real life situation/problem and able to solve them by constructing a differential equation/ mathematical model.
3. Students will be able to find the Laplace representation as transforms of functions of one/two variable.

Subject Code: CS - 1201
Subject Name: Programming and Data Structure
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Designing principles of algorithms and data structures
2. Learning efficiency and scaling of algorithms

3. Learning essential algorithms in computing
4. Understanding generic data structures for common problems

B. Course Content:

Performance of algorithms: Basic concepts, Mathematical Background, Complexity Analysis, space and time complexity, asymptotic notations, Types of Date Structure.
Linear Data Structures: Arrays: one dimensional, multi-dimensional, Sparse Matrix, Elementary Operations.
Stacks: Representation, elementary operations and applications such as infix to postfix, postfix evaluation, parenthesis matching
Queues: Simple queue, circular queue, de-queue, elementary operations and applications.
Linked lists: Linear, circular and doubly linked lists, elementary operations and applications such as polynomial manipulation
Non-Linear Data Structures: Trees: Binary tree representation, tree traversal, complete binary tree, heap, binary search tree, height balanced trees like AVL tree and 2-3 tree, tries, red-black tree, B-tree, B+ tree, m-way Search tree, other operations and applications of trees. **Graphs:** representation, Adjacency list, graph traversal, path matrix, connected components, topological sort, Spanning tree, BFS, DFS.
Sorting and Searching: *Sorting:* Selection sort, bubble sort, quick sort, merge sort, heap sort, insertion sort, selection sort, radix sort. *Searching:* linear and binary search, *Hashing:* hash tables, hash functions, and open addressing.
File structures: Introduction, data file types, file organization, file access methods.

C. Text Books:

1. Lipschutz S., Data Structure, McGraw Hill Education, 2014.
2. Deshpande P.S., Kakde O.G., C & Data Structures, Charles River Media, 2004.
3. Balagurusamy E., Data Structures Using C, McGraw Hill Education, 2017.
4. Srivastava S.K., Srivastava D., Data Structures Through C In Depth, BPB Publications, 2004.

D. Reference Books:

1. Drozdek A., Data Structures and Algorithms in C++, Cengage Learning, 2012.
2. Radhakrishnan M., Srinivasan V., Data Structures Using C, BPB Publications, 2008.
3. Gupta P., Aggarwal V., Varshney M., Data Structure Using C, Laxmi Publications, 2011.
4. Aho A.V., Hopperoft J.E., UIlman J.D., Data Structures and Algorithms, Pearson, 1998.
5. Tanenbaum A.M., Data Structures using C, Pearson Education, 2009.
6. Agarwal A., Data structure Through C, Cyber Tech Publications, 2005.
7. Bandyopadhyay S.K., Data Structures Using C, Pearson Education India, 2009.
8. Thareja R., Data Structures Using C, Oxford University Press, 2011.

E. Course Outcomes:

After successfully completion of this module students will be able to:

1. Assess performance efficiency of sequential algorithms.
2. Design data structures to enable algorithms and design sequential algorithms for performance.
3. Implement designing algorithms and corresponding data structures using object oriented programming languages.
4. Demonstrate deployment of essential data structures such as lists, stacks, queues, and trees.

Subject Code: EC - 1201
Subject Name: Introduction to Digital Engineering
Credit Point: 2 **(**L=2, T=0, P=0)

A. Course Objectives

The objective of the course is:

1. Understand different digital technology used in everyday life.
2. Work with electrical circuits in cascaded form and implementation in real world.

B. Course Content

Introduction- What is *digital* (analog vs. digital)? What is *technology*? History of Computing/Internet. Hardware – from electricity to hardware to software. Binary Arithmetic- Boolean Logic. Computer Architecture- Quantum computing. IoT - Introduction to principles and uses. BIG DATA - Introduction to principles and uses.VR/AR - Introduction to principles and uses. AI - Introduction to principles and uses. Blockchain - Introduction to principles and uses

Databases and mySQL queries, Networking Protocols. Introduction to Data Analytics, Machine Learning, Security, Quantum Technology and Cyber Physical System (CPS). Careers in Digital Technologies. Ethics and the Future of Computing. Model based analysis; Data driven analysis

C. Text Books

1. B. Marr, “Tech Trends in Practice: The 25 Technologies that are Driving the 4th Industrial Revolution”, Wiley, 2020.

D. Reference Books

1. A. Goel, “Computer Fundamentals”, Pearson, 2010.

E. Course Outcomes

At the end of the course, a student will be able to:

1. Understand basic fundamentals of different digital techniques
2. Understand the fundamentals of AI, Block chain and its use
3. Understand different network protocols.

Subject Code: MH-1201
Subject Name: Introduction to Innovation and Creativity
Credit Point: 2 (L=2, T=0, P=0)

A. Course Objectives:

The course is designed to meet the objectives of:

1. To involve themselves in the innovation and creative activities
2. Starting innovative practices in their entrepreneurial activities.
3. Developing their skills on the traits that they want to carry forward.
4. Starting activities based on the search of new ideas.

B. Course Content:

Introduction to innovation and creativity, opportunity identification: the search for new idea, entrepreneurial imagination and creativity, The role of creative thinking, Components of creativity, Indication of creativity, Developing your creativity, the creative thinking process, Two approaches to creative problem-solving, the most common idea killers, Arenas in which people are creative, the creative climate, Innovation and entrepreneur, the innovation process, types of innovation, Proof of Concept(PoC), product development, the major misconceptions of innovation, principles of innovation, Methods to initiate ventures, creating new ventures: new-new approach & new-old approach, ways to develop personal creativity: recognise relationships, develop a functional perspective, use your brains, and eliminate muddling mind –sets, design thinking, design innovation, technological innovation and designing entrepreneurship, creative design. Case study on startup/unicon

C. Text Books:

1. Donald F. Kuratko, Entrepreneurship: Theory, Process, Practice Cengage Learning 2017.
2. Cynthia, L. Greene, Entrepreneurship Ideas in Action. Thomson Asia Pvt. Ltd., Singapore. 2004.

D. Reference Books:

1. Barringer Entrepreneurship: Successfully Launching New Ventures, Pearson Education Publishing 2015
2. Timmons, Jerry A., and Spinelli, Stephen, 2009. New Venture Creation: Entrepreneurship for the 21st Century, 8th Edition, Boston, MA: IrwinMcGraw-Hill
3. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001

E. Programme Outcomes:

1. Start their venture more scientifically.
2. Start their venture by linking with the all the stakeholders.
3. Enable to identify various opportunity mapping
4. Explore many possibilities of generating new idea leading to enterprise.

Subject Code: ME-1201
Subject Name: Engineering Mechanics
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Student gets a basic idea of Centre of gravity, moment of inertia, mass moment of inertia, friction.

B. Course Content:

Forces and Moments: Force, moment and couple, wrench, equivalent force and moment, forces in space equilibrium, FBD, general equations of equilibrium-Lami's theorem, analysis of forces in truss and frames, brief introduction to vector approach.

Friction: Introduction to dry friction, laws of friction, friction of simple machines, inclined planes, screw jacks, clutch, and collar pivot bearing (uniform wear and uniform pressure assumptions).

Centre of gravity and moment of inertia: Centre of gravity, volume and composite bodies, area moment of inertia and mass moment of inertia for plane figures and bodies.

Virtual work and energy method: Virtual displacement; principle of virtual work; applications of virtual work principle to machines.

Kinematics of particle: Introduction, rectilinear motion, plane curvilinear motion, rectangular coordinates (x-y), normal and tangential coordinates (r-θ).

Kinetics of particle: Review of force, mass, acceleration, work and energy, impulse, momentum, linear impulse and linear momentum, angular impulse and angular momentum, impact, central-force and motion, and relative motion,

Kinetics of system of particles: Introduction, generalized Newton's second law, work-energy, impulse-momentum, conservation of energy and momentum, steady mass flow, variable mass.

Plane kinematics of rigid bodies: Introduction, rotation, absolute motion, relative velocity, instantaneous center of zero velocity, relative acceleration, motion relative to rotating axes.

Plane kinetics of rigid bodies: Introduction, general equation of motion, translation, fixed axis rotation, general plane motion, work energy relations, acceleration from work-energy, virtual work, impulse-momentum equation.

C. Text Books:

1. Timoshenko S and Young D.H., "Engineering Mechanics", MGH, 2017, 5th Ed.
2. Beer and Johnston, "Vector Mechanics for Engineers: Statics and Dynamics", TMGH, 2012, 10th Ed.

D. Reference Books:

1. Meriam, J. L. and Kraige, L. G., "Engineering Mechanics, Volume 1: Statics", Wiley, 2017, 8th Ed.
2. Meriam, J. L. and Kraige, L. G., "Engineering Mechanics, Volume 2: Dynamics", Wiley, 2006, 5th Ed.
3. Shames, I. H. and Rao,G. K., "Engineering Mechanics: Statics and Dynamics'", Pearson 2006, 4thEd.
4. Nelson A., "Engineering Mechanics: Statics and Dynamics", TMGH, 2017, 1st Ed.

E. Course Outcomes:

1. Basic understanding of different type of forces, moments and resolving them.
2. Evaluation of centre of gravity, moment of inertia and mass moment of inertia for various figures & bodies.
3. Apply principles of kinematics, kinetics and effects of friction for solving problems.

Subject Code: CE 1201
Subject Name: Surveying - I
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the importance of surveying in the field of civil engineering

2. To study the concepts of levelling and contouring
3. To understand the methods of chain and compass surveying
4. To get introduced to different plane and geodetic surveying applications
5. Understand the concepts of theodolite-based surveying.

B. Course Content:

Introduction: Definition of surveying, primary divisions of surveying, object and classification of surveying, principles of surveying, approximate methods of chine and tape surveying, unfolding and folding of a chain, instruments for chaining and taping, measurement by tape and chain, errors in tape measurements and their corrections, testing and adjusting of a chain, chaining on flat and sloping ground, obstacle in chaining, direct and indirect methods of ranging, methods of traversing, principle basic definitions, bearings and meridians, prismatic compass, surveyors compass, azimuthal and quadrantal bearing systems, true north and magnetic north, magnetic declination, local attraction and its correction.

Levelling and contouring: Definition of terms, principles of levelling, types of levels, levelling staffs, booking and reduction in field book, balancing of sights, errors curvature and refraction, distance of visible horizon, reciprocal levelling, and its merits, contour, contour interval, horizontal equivalent, contour gradient, factors affecting contour interval, characteristics of contours, direct and indirect methods of contouring, uses of contour maps.

Plane table surveying: Principles, merits and demerits, instruments and other accessories, methods used, radiation, traversing, resection, intersection and their uses, two and three point problem.

Area: Measurement of Area, Computation of area by Geometrical Figure, Area of offsets, Area from co- ordinates, Area by planimeter, Digital Planimeter

Volume: Definitions, Methods of measurement of volume. Measurement from cross-sections, Types of cross- sections and areas, prismoidal correction, curvature corrections

Theodolite: Vernier and microscopic theodolite, construction, temporary and permanent adjustments, measurements of horizontal and vertical angles, methods of repetitions and reiteration, sources of errors, checks in traversing, omitted measurements.

C. Text Books:

1. Duggal S.K., Surveying Volume-I, Tata McGraw Hill Publisher, New Delhi, 2017.
2. Arora. K.R., Surveying Volume-I, Standard Publishers Distributors, 2019.
3. Punmia, B.C, Jain A. K, Jain A.K., Surveying Volume-I, Laxmi Publications, 2016.

D. Reference Books:

1. Agor R., A Textbook of Surveying and Levelling, Khanna Publishers, New Delhi, 2015.

2. Kanetkar T P, Surveying and Levelling, Pune Vidyarthi Griha Prakashan, Pune, 2006.

E. Course Outcomes:

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

1. Understand the basics of surveying and the role of surveyor
2. Be aware of the role of surveying in the site investigation before carrying out any construction work.
3. Understand the methods of chain and compass surveying
4. Recognize the concepts of levelling and contouring
5. Have the knowledge of various surveying equipment and their uses such as theodolite, compass, plane table etc.

Subject Code: CE-1202
Subject Name: System Design
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the basic concept of system level input & output
2. To understand the Life Cycle Planning and Life Cycle integration
3. To study the management of complex systems over their life cycles

B. Course Content:

Under System Engineering Landscape

Basic concept of system level input & output with qualities, properties, characteristics, functions, behaviours & performance. System Engineering Major Process flow (Concepts of Interdisciplinary design, integration, complex systems, and life cycles

System Engineering Stages

1. Analysis of base level Requirement and appropriate Management.
2. Functional Analytics, Interpretation and Allocation of inference.
3. Design Synthesis.
4. Systems Analysis and Control.
5. Verification.
6. Conclusion

System Engineering Types (concept of product system, service system, enterprise system and system of systems)

Systems engineering responsibilities

a. Management and monitoring of all installed systems and infrastructure.

b. Installation, configuration, testing and maintaining operating systems, application software and system management tools.
c. Ensure the highest levels of quality standards on systems and infrastructure.

System Engineering Skill (for analysis, problem solving, and conflict resolution)

a. Communication skill
b. Interpersonal skill
c. Project management skill
d. Governance skills

Under System Development Process

a. Life cycle Planning and Life Cycle integration
b. System Development Life Cycle Phasing (planning, analysis, design, development, testing, implementation, and maintenance).
c. Industrial System Engineering (Quality Function Deployment, Product Planning, Design Planning, Production & Operational Planning, Planning for Quality Control & Assurance, Whole Value chain concept).

Under System Engineering Management.

a. Management of complex systems over their life cycles.

C. Text Books:

1. Sage A. P., Rouse W. B., Handbook of Systems Engineering and Management, Wiley, 2014.
2. Friedenthal S., Moore A., Steiner R., A Practical Guide to SysML: The Systems Modeling Language, 2014.

D. Reference Books:

1. Sage A. P., Rouse W. B., Handbook of Systems Engineering and Management, Wiley, 2014.
2. Friedenthal S., Moore A., Steiner R., A Practical Guide to SysML: The Systems Modeling Language, 2014.

E. Course Outcomes:

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

1. Comprehend the basic concept of system level input & output.
2. Comprehend the Life cycle Planning and Life Cycle integration.
3. Comprehend the management of complex systems over their life cycles.

Subject Code: ME-1204
Subject Name: Workshop Practice-I
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. Students able to understand different tool &equipment for work shop practice.
2. Students acquire skills for the preparation of different Carpentry/fitting/welding models.
3. Students able to understand the safety precaution in the workshop
4. Student acquires skills of Application orientated tasks.

B. Course Content:

Introduction and demonstration: Introduction to various shops/ sections and workshop layouts,safety norms to be followed in a workshop should be conveyed to students.

Carpentry shop: Introduction of tools and operations, types of woods & their applications, types of carpentry hardware and their uses, carpentry joints, carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, types of woods and carpentry hardware.

Fitting shop: Introduction of tools and operations, types of marking tools and their uses, types of fitting cutting tool and their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.

Metal joining shop: Introduction of tools, types of welding joint, arc welding, gas welding and gas cutting.

Machine shop: Introduction of machine tools and operations, demonstrations of basic machine tools like lathe, shaper, drilling, milling machine and CNC with basic operations and uses.

List of workshop practices:

a. Hands on practice and job making in carpentry.
b. Hands on practice and job making in fitting.
c. Hands on practice and job making in welding.
d. Demonstrate the operations of machine shop.

C. Text Books:

1. Choudhury Hajra S.K., Choudhury Hajra A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology Vol. I & II", Media promoters and publishers private limited, Mumbai, 2008 and 2010.
2. Raghuvanshi B.S., "Workshop Technology Vol. I & II", Dhanpath Rai & Sons, 2017.
3. Bawa H S., "Workshop Practices", Tata McGraw-Hill, 2009.

D. Reference Books:

1. John K.C., "Mechanical Workshop Practice", PHI, 2010, 2nd Ed.
2. Kannaiah P. and Narayana K.L., "Workshop Manual, Scitech publishers", 2009. 2nd Ed.

E. Course Outcomes:

1. Study and practice on machine tools and their operation.
2. Select the appropriate tools required for specific operation.
3. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
4. Identify and apply suitable tools for machining processes including turning, facing, thread cutting and tapping.

Subject Code: CE-1203
Subject Name: Do it Yourself (DIY) / Industry Exposure
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. Students are exposed to real time civil engineering projects.
2. Students acquires skills of application-oriented tasks in civil engineering

B. Course Content:

Industrial Visit, skill development activities in the domain of civil engineering

C. Course Outcomes:

Students successfully completing this module will be able to:

1. Study and practice on providing economical solution to the real-world problems

Subject Code: BS-1202
Subject Name: Engineering Chemistry Laboratory
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. To enable the students to acquire knowledge about chemistry practical and its technological importance towards research works.
2. To understand applicability of chemistry for engineering and research purposes.
3. To make them apply the knowledge of fundamental chemistry for design system components or processes and researches considering the public health and safety, and the cultural, societal, and environmental considerations.

B. List of Experiments:

1. Determination of the concentration of NaOH solution.
2. Standardization of $KMnO_4$ solution by Mohr's salt.
3. Estimation of hardness of water using EDTA titration.
4. Conductometric titration for
   a) Determination of the strength of a given HCl solution by titration against a standard NaOH solution.
   b) Analysis of a mixture of strong and weak acid by strong base.
5. Estimation of available chlorine in bleaching powder.
6. Determination of pH value of the solution by digital pH meter and pH paper.

C. Reference Books:

1. Rao M. V. B., Laboratory Mannual for Engineering and Physical Chemistry, Studium Press (India) PVT. Ltd. 2013.
2. Israel V. A., Vogel's Qualitative Inorganic Analysis, Publisher: Pearson Education Limited, ISBN: 9780582218666, 0582218667

D. Course Outcomes:

After studying this course, students will be able to

a) Function on research areas in multidisciplinary subjects.
b) Design economically, environmental friendly and new methods of synthesis for various needful products.
c) Perform titration for various kinds of acid-base for new experimental

Subject Code: CS-1204
Subject Name: Programming and Data Structure Laboratory
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

The course is designed to meet the objectives of:

1. To implement linear and non-linear data structures
2. To understand the different operations of search tree
3. To implement graph traversal algorithms
4. To get familiarized to sorting and searching algorithms

B. Course Content:

Laboratory assignments will be based on the implementation of the basic operations and application algorithms (as mentioned below) using various data structures. Programs are to be implemented using any preferable language such as C, C++, Java.

Array implementation of Stack and Queue ADTs.
Array implementation of List ADT.
Linked list implementation of List, Stack and Queue ADTs.
Applications of List, Stack and Queue ADTs.
Implementation of Binary Trees and operations of Binary Trees.
Implementation of Binary Search Trees.
Implementation of AVL Trees.
Implementation of Heaps using Priority Queues.
Graph representation and Traversal algorithms.
Applications of Graphs.
Implementation of searching and sorting algorithms.
Hashing – any two collision techniques.

C. Text Books/ Reference Books:

1. Mehta D.P., Sahni S., Handbook of Data Structures and Applications, Chapman and Hall, 2020.
2. Goodrich M.T., Tamassia R., Mount D. M., Data Structures and Algorithms in C++, Wiley, 2011.
3. Langsam Y., Augenstein M.J., Tenenbaum A.M., Data Structures Using C and C++, Pearson Education, 2011.

D. Course Outcomes:

After successfully completion of this module students will be able to:

1. Write functions to implement linear and non-linear data structure operations.
2. Suggest appropriate linear / non-linear data structure operations for solving a given problem.
3. Appropriately use the linear / non-linear data structure operations for a given problem.
4. Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval

Subject Code:MH-1202
Subject Name: Gandhian Philosophy and Technology
Credit Point:1 (L=0, T=0, P=2)

A. Course Objectives:

The course is designed to meet the following objectives:

1. To understand the life style and significance of M. K. Gandhi in modern world
2. To introduce Gandhian Thought as an academic discipline to students
3. To convey the importance of Gandhian Values in different walks of life
4. To create awareness about the significance of Gandhian Thought for Academics and life in general, in students and common stakeholder through workshop and related activities done by Gandhi Study Center

B. Course Content:

Ethics in Gandhian Thought: Socio- Political and Economic Thoughts of Gandhiji, Gandhian methods for Global Peace, Gandhian Development, Mahatma Gandhi's Perspectives on Technology. Participating practical oriented activities done by GSC/ Technology-attributes/innovation/activities of Gandhian way of life styles/Gandhian economics, Indian cottage industry and its improvement, Inclusive growth and through sustainable development

C. Text Books:

1. Gandhi, Gopal krishna, Mohandas Karamchand Gandhi: Restless as Mercury, My Life as a Young Man, Aleph Book Company, 2021.
2. Beitzel, Terry and et al. Reflections on Mahatma Gandhi: The Global Perspectives, Rawat Publications, India, 2021.
3. Gandhi, M.K. The story of my experiments with truth (an autobiography), Navajivan Publishing House, 1927.

D. Reference Books:

1. Awasthi, R.K. Technological Transformation and Relevance of Gandhi in Modern India, IJSW online, Retrieved May 2022.
2. Talwar, Sushant. Mahatma and machines: Understanding Gandhi's thoughts on modern technology, https://www.timesnownews.com/, 2019.
3. Kothari,L. S. Science and Technology in India: What Can We Learn From Gandhi?, Source: International Seminar on Gandhi And The Twenty First Century, (January 30-February 4, 1998) New Delhi- Wardha.
4. Ram K.Vepa, New Technology: A Gandhian Concept, Gandhi Book House New Delhi, 1975

E. Course Outcomes:

By the end of this course, you will be able to:

1. Understand how a simple thought changes the world
2. Identify the various barriers and challenges faced in India and try to solve from Gandhian perspectives
3. Dedicate your ideas to poor people and transform technology among people
4. Aware of the economic and social equality and relationship with peace

III Semester						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	BS-2101	Engineering Mathematics-III	3	0	0	3
2	CE-2101	Mechanics of Solids	3	0	0	3
3	CE-2102	Fluid Mechanics - I	3	0	0	3
4	CE-2103	Transportation Engineering - I	3	0	0	3
5	CE-210A / CE210B	Engineering Geology/ Remote Sensing and GIS	3	0	0	3
6	CE-210X	OE1*	3	0	0	3
7	CE-2104	Surveying Laboratory - I	0	0	2	1
8	CE-2105	Fluid Mechanics Laboratory - I	0	0	2	1
9	CE-2106	Structural Mechanics Laboratory	0	0	2	1
Contact Hours			18	0	6	
Total Credits						21

Subject Code: BS-2101
Subject Name: Engineering Mathematics - III
Credit Point: 3 (L=3, T=0, P=0)

A. Course objectives:

The course is designed to meet the objectives of:

1. Imparting theoretical knowledge and practical application to the students in the area of Stochastic Process,
2. Introducing the basic notions of probability theory and develops them to the stage where one can begin to use probabilistic ideas in statistical inference and modeling, and the study of stochastic processes,
3. Providing confidence to students in manipulating and drawing conclusions from data and provide them with a critical frame work for evaluating study designs and results,
4. Injecting future scope and the research directions in the field of stochastic process.

B. Course Content:

Probability: Random Experiment, Sample space; Events; Probability of events, Frequency Definition of probability; Axiomatic definition of probability; Finite sample spaces, Probability of Non-disjoint events (Theorems). Conditional probability; General Multiplication Theorem; Independent events; Bayes'theorem and related problems.

Random variables: Probability mass function; Probability density function and distribution function. Distributions: Binomial, Poisson, Uniform, Exponential, Normal, t and $\chi 2$. Expectation and Variance (t and $\chi 2$ excluded); Moment generating function; Transformation of random variables (One variable); Central limit theorem (Statement only).

Basic Statistics: Measures of Central tendency: Moments, skew-ness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression– Rank correlation.

Statistics: Population; Sample; Statistic; Estimation of parameters (consistent and unbiased); Sampling distribution of sample mean and sample variance (proof not required).

Estimation: Maximum likelihood estimate of statistical parameters (Binomial, Poisson and Normal distribution). Interval estimation (Normal distribution). Testing of hypothesis and $\chi 2$ goodness of fit.

Curve fitting: Linear and Nonlinear

C. Text Books

1. Rohatgi V. K. and Saleh A. K. Md E., An Introduction to Probability and Statistics,Willy, 2008, 2nd edition.Gupta S. C., & Kapoor V. K., Fundamental of Mathematical Statistics, Sultan Chand &Sons, 2014.

D. Reference Books

1. Ross S. M., Introduction to Probability Models, Academic Press, 2014, 14th edition.
2. Cramer H., Random Variables and Probability Distributions, Cambridge University Press, 2014, Revised ed.
3. Spiegel M. R., Probability and Statistics, McGraw-Hill, 2017, 3rd edition.
4. Mayer P. L., Introductory Probability and Statistical Applications, Oxford & IBH, 1970, 2nd ed.
5. Feller W., An Introduction to Probability Theory and Its applications, Vol I, Jon Willy and Sons, 2008, 3rd edition.
6. Chung K. L., A course of Probability Theory, Academic Press, 2000, 3rd edition.

E. Course Outcomes:

Upon Completion of the subjects:

1. Students will add new interactive activities to fill gaps that we have identified by analyzing student log data and by gathering input from other college professors on where students typically have difficulties.

2. Students will add new simulation-style activities to the course in Inference and Probability, Student s will be able to take up prospective research assignments.

Subject Code: CE-2101
Subject Name: Mechanics of Solids
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To learn about the concept of stress, strain, stress-strain relationship and deformation of solids.
2. To know the concepts of virtual work, strain energy, principal stress and strains, and stress-strain relationships for elastic and composite bars.
3. To learn the bending moment, shear force and the corresponding stress distribution for different types of beams.
4. To study the torsion behaviour of solid and hollow circular shafts.
5. To learn different methods for analysis of columns and their buckling loads.

B. Course Content:

Stress: Types of forces, Definition of stress, Stress tensor, plane stress, differential equations of stress equilibrium, Principal stresses, maximum shear stress, Mohr's Circle, stress invariants, Stresses due to impact.

Strain: Definition of strain, strain tensor, Plane strain, Saint Venant's equation of compatibility, Principal strains, strain invariants, Poisson's ratio, volumetric strain, thermal strain and deformation, strain rosettes.

Stress-Strain Relationships: Hooke's Law, constitutive relations, deformation of axially loaded bars, composite bars, elastic constants, generalised Hook's law for isotropic materials, Elastic strain energy, theories of failure, Octahedral shear stress.

Torsion: Torsion of circular elastic bars, torsion equation, warping of non-circular bars, power transmitted by shaft and hollow circular sections, closed and open coiled helical springs - leaf spring.

Bending Moment and Shear force: Beams and support conditions, Types of supports and loads, shear force and bending moment, their diagrams for simply supported beams, cantilevers, and overhanging beams.

Bending Stress and Shear Stress: Theory of simple bending–Stress distribution at a cross section due to Bending Moment and Shear Force, Curved bars, Unsymmetrical bending, Product moment of inertia, shear centre, thin and thick-walled cylinder.

Deflection of beams: Moment curvature relation of beam, differential equation of beam, slope and deflection for determinate structures using integration, moment area and conjugate beam method.

Elastic Stability of Columns: Short and Long Column, stability of a long column, Euler's Theory of Columns, differential equations of beam- columns, Derivation of Buckling Load for different end conditions, Rankine's Formula.

C. Text Books:

1. Timosenko, S. P., and Young, D.H., Elements of Strength of Materials, East-West Press Pvt. Ltd., 2004.
2. Srinath, L.S, Desai. P., Strength of Materials, Tata McGraw-Hill, 2010.
3. Popov, E.P., Engineering Mechanics of Solids, PHI, 2015.

D. Reference Books:

1. Shames, H, Introduction to Solid Mechanics, PHI, 2000.

E. Course Outcomes:

1. Analyse the stress-strains behaviour of solids.
2. Determine the stresses and strains in the members subjected to axial, bending and torsion.
3. Evaluate the failure of circular and cylindrical shafts subjected to torsion.
4. Evaluate the deflection of beams subjected to loads.
5. Derivation of buckling load of columns for different end conditions.

Subject Code: CE - 2102
Subject Name: Fluid Mechanics - I
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the basic fluid properties.
2. To study the fluid kinematics including stream lines and path lines.
3. To apply the concepts of continuity and momentum principles in fluid mechanics.
4. To study about the fluid flow through pipes.

B. Course Content:

Introduction: Purpose of study of fluid mechanics in the fields of Civil and other Engineering. Fundamental difference between a solid and a fluid, constituent relationship for solids and fluids, conservation principles applied in fluid mechanics.

Properties of fluids: viscosity, compressibility, ideal and real fluids, Newtonian and non-Newtonian fluids, surface tension.

Pressure at point: Pascal's law, Stress at a point, Variation of pressure with elevation in compressible and incompressible fluids, hydrostatic law, Pressure measurement, piezometers and manometers, buoyancy, stability of submerged and floating bodies.

Fluid flow: with reference to translation, rotation and deformation, concept of continuum, control mass & control volume approach, Reynolds transport theorem.

Velocity field: one & two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, equipotential lines, standard flow patterns, combination of flow patterns, flow net method, use and limitations.

Forces exerted in a fluid flow: derivation of continuity equation and Euler's equation, Bernoulli's equation and its applications, Momentum equation and its applications.

Measurement of flow in pipes: orifice, mouthpiece and venturimeter, notches, Moody diagram, friction factor.

Laminar flow and its characteristics: Navier-Stokes equation - exact solutions, Laminar flow between parallel plates, Laminar flow through pipes, Hazen-Poiseuille equation, Reynolds experiment, head loss in flow through pipes, Darcy Weisbach equation, losses in pipe transitions, Turbulence, Prandtl's mixing length theory.

Dimensional Analysis: Dimensional homogeneity, Non-Dimensional parameter, Π theorem, dimensional analysis, choice of variables, Reyleigh methods.

C. Text Books:

1. John. M. Cimbala and Yunus A. Cengel, Fluid Mechanics: Fundamentals and Applications, McGraw-Hill Publication, 2020.
2. F M White, Fluid Mechanics, Tata McGraw Hill Publication, 2011.
3. Ethirajan Rathakrishnan, Fluid Mechanics: An Introduction, PHI Publication, 2012.

D. Reference Books:

1. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid Mechanics, Wiley India Edition, 2011.
2. Bidya Sagar Pani, Fluid Mechanics: A Concise Introduction, PHI Publication, 2016.

E. Course Outcomes:

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

1. Understand the various properties of fluid
2. Apply conservation laws to solve steady state fluid flow problems
3. Analyse the characteristics of flow through pipes
4. Explore the principles of dimensional analysis
5. Investigate the various measurement methods in pipe and open channel

Subject Code: CE-2103
Subject Name: Transportation Engineering - I
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Provide a systematic understanding of the causes and motivations of highway location, planning and geometric design.
2. To have idea about road planning and development
3. To have idea about the pavement design
4. To have idea about the hill roads and highway maintenance

B. Course Content:

Road development and planning: Brief history of road development, Road cross section, necessity of transportation planning, classification of roads, road patterns, planning surveys, saturation system, highway planning in India, road development plans.

Highway location and alignment: Basic requirements of an ideal alignment and factors controlling, engineering survey for highway location, drawing and reports, highway projects.

Highway geometric design: Highway cross section elements, sight distances, Design of horizontal alignment, Transition curves and vertical alignment.

Pavements design: Design factors, Design of flexible pavements, CBR, GI and Bur mister methods, Design of rigid pavements.

Pavement materials: Soils, Aggregates and their characteristics, bituminous materials and mixtures, Portland cement concrete, Experimental characterization of various pavement and subgrade materials, Application of Superpave method of pavement material characterization.

Unpaved/Rural Roads: Unpaved roads, their typologies, analysis and design of unpaved roads, Introduction to PMGSY for improvement of rural roads.

Hill roads: General considerations, alignment, geometric design and construction, drainage and maintenance problems in hill roads.

Highway maintenance: Pavement failures, maintenance of highway pavement, evaluation and strengthening of existing pavements, subgrade stabilization techniques using soil replacement, hydraulic modification, chemical additives, mechanical techniques and geosynthetic-based techniques for subgrade improvement.

C. Text Books:

1. Khanna K S., Justo C E G., Veeragavan A., Highway Engineering, Nem Chand & Bros, 2020.

2. Kadiyali R. L., Transportation Engineering, Khanna Publishers, 2021.
3. Venkatramiah C., Transportation Engineering (Highway Engineering), Orient Blackswan private limited, 2015.

D. Reference Books:

1. Papacostas S C., Prevedouros D P., Transportation Engineering, PHI publishers, 2016.
2. Chakroborty P., Principles of Transportation Engineering, PHI publishers, 2020.

E. Course Outcomes:

1. Students will idea about the history of road development and planning in India
2. Students will be confident in flexible and rigid pavement designing
3. Students will have idea about the construction of highways
4. Students will be able to do planning and development of hill roads
5. Students would get an overview of the highway maintenance and subgrade stabilization

Subject Code: CE - 2104
Subject Name: Surveying Laboratory - I
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. To study the basic information about the equipment used in surveying.
2. To understand the measuring techniques used for collecting linear and angular measurements.
3. To carry out area and volume calculation. To perform levelling and contouring works.

B. Course Content:

1. To practice Chaining and tape methods of ranging and to measure the distances between two points (Direct ranging).
2. To carry out the Indirect ranging in the field.
3. To measure bearings of sides of traverse with prismatic compass and computation of included angles.
4. To determine the R.L of a given point using level by rise and fall method.
5. To determine the R.L of a given point using level by height of the instrument.
6. To carry out the differential levelling in the field.
7. To prepare the contour map of an area by the method of radial lines.
8. To carry out Plane table survey by the method of radiation.
9. To carry out Plane table survey by the method of intersection.

10. To carry out traversing using Theodolite.

C. Text Books:

1. Duggal S.K., Surveying Volume-I, Tata McGraw Hill Publisher, New Delhi, 2017.
2. Arora. K.R., Surveying Volume-I, Standard Publishers Distributors, 2019.
3. Punmia, B.C, Jain A. K, Jain A.K., Surveying Volume-I, Laxmi Publications, 2016.

D. Reference Books:

1. Punmia, B.C, Jain A. K, Jain A.K., Surveying Volume-I & II, Laxmi Publications, 2016.
2. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.
3. James A, Edward M, Surveying Theory and Practice, Tata Mc Graw Hill, 2012.
4. Charles D.G., Paul R.W., Elementary Surveying, Prentice Hall, 2014.

E. Course Outcomes:

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

1. Understand the field conditions to plan and collect field data.
2. Prepare field notes from surveyed data.
3. Interpret survey data and compute area and volume.
4. Find the elevations from field data
5. Set out alignments of engineering constructions in the field.

Subject Code: CE-2105
Subject Name: Fluid Mechanics Laboratory - I
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. Develop procedure for standardization of experiments
2. To study the discharge measurement devices
3. To learn the properties of various types of fluid flow
4. To study about the fluid flow through pipes

B. Course Content:

1. Discharge measurement using Venturimeter.
2. Discharge measurement using Orifice and mouthpiece
3. Discharge measurement using triangular notch and rectangular notch
4. Determination of Darcy's friction factor, relative roughness for laminar and turbulent flows

5. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
6. Minor Losses in a Pipeline
7. Verification of Bernoulli's equation

C. Reference Books:

1. K.L. Kumar, Engineering Fluid Mechanics - Experiments, Eurasia Publishing House, 2014.
2. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995.

D. Course Outcomes:

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

1. Calibrate the flow discharge measuring device
2. Determine the flow discharge
3. Distinguish between laminar and turbulent flows
4. Understand the flow through pipes

Subject Code: CE-2106
Subject Name: Structural Mechanics Laboratory
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To find the Young Modulus, torsional strength, hardness and tensile strength of given specimens.
2. Finding stiffness of open coiled and closed coiled springs.

B. Course Content:

1. To determine hardness of material with the help of the following methods:
   i. Rockwell test
   ii. Brinell test
   iii. Vickers test
2. To determine the impact strength of materials with the help of pendulum type impact testing machine.
3. To determine tensile properties of ductile material with the help of Universal testing machine (UTM).
4. To determine the creep and fatigue of a material using Creep testing and Fatigue testing machine.

C. Text Books:

1. Ramamrutham, S., Narayan R., Strength of materials, Dhanpat Rai Publishing Company, 2008.
2. Bansal, R. K., A textbook of strength of materials, Laxmi Publications, 2010.
3. Gere, J.M., Timoshenko, S.P., Mechanics of Materials, CBS Publishers, 2011.
4. Junarkar. S. B, Charotar S.H.J, Mechanics of Structures, Anand Publishers, 2017.

D. Reference Books:

1. Singer, F. L., Pytel, A., Strength of Materials, Harper and Row Publishers, 2018.
2. Hibbeler, R. C., Mechanics of materials, Pearson Publications, 2018.
3. Srinath, L. S., Advanced mechanics of solids, McGraw Hill Publications, 2017.
4. Krishna Raju, N., Advanced Mechanics of Solids and Structures, McGraw Hill Education, 2018.

E. Course Outcomes:

1. Understand the different physical properties of ductile materials.
2. Understand the use of universal testing machine (UTM).

Elective I

Subject Code: CE-210A
Subject Name: Engineering Geology
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To have knowledge of the origin of the earth and its structure and its position in the solar system.
2. To have idea about the physical, chemical properties and the occurrence of the minerals.
3. To have knowledge about the formation of different types of rock.
4. To have knowledge about the structural formations within earth, along with an overview of earthquakes and landslides.

B. Course Content:

General Geology: Branches and scope of geology, Earth, its position in the solar systems, surface features and internal structure, work of natural agencies like lakes,

oceans, atmosphere, wind, streams, sea, glacier, Earth movements. Types of weathering, mountains and mountain building.

Mineralogy: Definition of crystal and a mineral, the study of the physical properties and occurrence of quartz, Feldspar, Mica, kyanite, calcite, tale, corundum, gypsum, fluorite, biotite, muscovite, graphite, realgar, magnetite, limonite, pyrite, galena, barite, dolomite, garnet, tourmaline, chal-copy-rite, opal, topaz, autite, hornblende, epidate, kaolinite, diamond.

Petrology: Formation and classification of rocks into three types, Igneous, sedimentary and metamorphic rocks, description of physical properties for constructional purposes of granite, pegmatite, dolerite, gabbzo, basalt, sandstone, conglomerate, breccias, limestone, shale, schist, marble, quartzite, khondalite, slate, gneiss, andesite, stratigraphy of India (a general idea), principles of correlation, fossils, their preservation and significance.

Structural geology: Strike and dip, out crops, volcanoes, overlaps, inliers and outliers, types of classification of folds, faults, joints, unconformities.

Earthquakes and landslides: Classification, causes and effects of earthquakes and landslides, seismic curve, seismographs, seismograms, accelograms, seismic problems of India, seismic zones of India, remedial measures to prevent damage for engineering structures against earthquakes and landslides, case histories of earthquakes and landslides induced failures and mitigations.

C. Text Books:

1. Singh P., Engineering and General Geology, S.K. Kataria and Sons, 2016.

D. Reference Books:

1. Bangar K. M, Principles of Engineering Geology, PHI, 2019.

E. Course Outcomes:

1. Student will have knowledge about the Origin of earth.
2. Students will be confident in preparing the geological map.
3. Students will be able to use of aerial map in geological surveying.
4. Students will be able to distinguish between the different types of rocks and minerals.

Subject Code: CE-210B
Subject Name: Remote Sensing and GIS
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To have idea about GIS data and database.

2. To know about the data elevation modelling.

B. Course Content:

Introduction to GIS: Introduction – GIS definition, development, application areas. GIS Applications-Transportation, Water Resources, Environment, Geology, Emergency Management, Agriculture, Urban planning, climate change, Business.

Introduction to remote sensing techniques: Advantages of Remote Sensing over conventional surveying methods Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Image Processing - Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised. Applications: Geosciences, Water Resources, Land use – Land cover, Transportation Engineering, Image Interpretation.

C. Text Books:

1. Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, 2007.
2. James B. Campbell, Randolph H. Wynne. Introduction to Remote Sensing, The Guilford Press, 2011.
3. Lillisand T.M and Kiefer R.W "Remote sensing and image Interpretation", John Wiley & Sons, 2008.

D. Reference Books:

1. Sabins F.F., Remote Sensing: Principles and interpretation, W.H. Freeman and Company, 2007.
2. Bhatta, "Remote sensing and GIS", Oxford Publishers, 2020.

E. Course Outcomes:

1. Students will idea about the basics of remote sensing.
2. GIS applications in transportation, water resources, and environment will be known.

IV Semester						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-2201	Structural Analysis - I	3	0	0	3
2	CE-2202	Environmental Engineering - I	3	0	0	3
3	CE-2203	Surveying - II	3	0	0	3
4	CE-220A / CE220B	Fluid Mechanics – II / Computational Fluid Dynamics	3	0	0	3
5	CE-220X	OE2*	3	0	0	3
6	MH-2201	Entrepreneur Essential and Early-Stage Start-up	3	0	0	3
7	CE-2204	Transportation Engineering Laboratory - I	0	0	2	1
8	CE-2205	Surveying Laboratory - II	0	0	2	1
9	CE-2206	Structural Engineering Laboratory	0	0	2	1
Contact Hours			18	0	6	
Total Credits						21

Subject Code: CE-2201
Subject Name: Structural Analysis - I
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the importance of degrees of freedom and the concept of principle of superposition.
2. To know about the concept of the different methods of finding deflection of beams and trusses.
3. To study the transformation of system matrices and element matrices for the determinate and indeterminate structures.
4. To analyse the forces in structures like continuous beam, truss and frames.
5. To analyse columns of varying end support conditions by Euler Theory and Rankine's formula.

B. Course Content:

Introduction - Classification of structures, Loads, Structural design.

Principle of virtual displacement and virtual forces - Castigliano's first theorem - Maxwell's reciprocal theorem.

Determination of deflection curve of beams- double integration - Macaulay's method - Area moment method - Conjugate beam method - strain energy and dummy unit load approaches to deflection of Simple and Curved members.

Statically indeterminate Structures -Propped cantilever, fixed and continuous beams - Theorem of three moments - Bending moment and shear force diagrams.

Deflection of trusses - Unit load method - Strain energy method - Williot Mohr's diagram.

Theory of columns - Axial load- Euler's theory- Rankines formula, combined bending and axial load.

Three Hinged Arches - Action of an arch - eddy's theorem - Three hinged, parabolic and segmental arches - determination of horizontal thrust, bending moment, normal thrust and radial shear.

C. Text Books:

1. Gupta S. P., Gupta R., Pandit G.S., Theory of Structures, Tata McGraw Hill Pub., 2017.
2. Negi, L. S., Theory and Problems in Structural Analysis, Tata McGraw Hill Pub., 1997.
3. Junarker. S. B., Charotar S.H.J., Mechanics of Structures, Charotar Publishers, 2008.
4. Rajput, R. K., Strength of Materials (Mechanics of Solids), S. Chand Limited, 2006.

D. Reference Books:

1. Wang, C.K., Intermediate structural analysis, McGraw-Hill Publishers, 2017.
2. Hibbeler, R.C., Tan K.H., Structural analysis, Pearson, 2017.
3. Vazirani, V. N., Ratwani M.M., Duggal S.K., Analysis of Structures (Analysis, Design and Details of Structures), Khanna Publishers, 1999.
4. Reddy, C. S., Basic structural analysis. Tata McGraw-Hill Publishers, 2017.

E. Course Outcomes:

1. Apply the principle of virtual work.
2. Determine deflection of a beam for various loading conditions.
3. Apply unit load method to find the deflection of truss.
4. Visualize the behaviour of column for combined bending and axial loading.
5. Behaviour of three hinged arches.

Subject Code: CE-2202
Subject Name: Environmental Engineering - I
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To learn to classify various water sources, causes of contamination and later effect on human health
2. Will learn about the physico-chemical and biological characteristics of water
3. To Calculate the water demand, population forecasting
4. To Design various components of water treatment plant and sewer system
5. To classify various plumbing layout and components

B. Course Content:

Water environment: Environment and Ecology, water resources of hydrosphere, different water pollutants and their impacts on human being, Population Forecasting and Water Demand sources of supply, yield, design of intakes, estimation of demand, design period. Water and waste water characteristics: Water quality criteria and standards for potable and industrial uses, control of water borne diseases, Physical, chemical and biological characteristics of domestic and industrial waste waters, significance of pollutant parameters and effluent discharge standards. Treatment objective and methods: Unit operations and processes and selection of treatment mode and sequence. Primary treatment: screening, neutralization, equalization, flocculation, sedimentation, floatation, stripping. Tertiary treatment: Oxidation/reduction, precipitation, adsorption, ion exchange and membrane Processes, disinfection. Conveyance and distribution systems:

Conductors: different pipe systems, design considerations, laying, testing and effects of pipe corrosion and its preventive measures. Sewers: hydraulic design, construction and appurtenances, operation and maintenance. Pumps and pumping: necessity, types of pumps, characteristics curves, selection criteria, economical diameter of pumping/transmission main, problems in sewage pumping. Distribution network: methods, layout, storage, and distribution reservoir, analysis of distribution systems. Plumbing systems: General principles, materials for service pipe, service connection, water meters, and valves, Principles of house drainage, pipes, traps, sanitary fittings, systems of plumbing, house drainage plans. Rural and semi urban sanitation: Collection and disposal of dry refuse, sullage, excretal waste, night soil disposal without water carriage, latrines, chemical toilets, precast units for low cost sanitation.

C. Text Books:

1. Punmia B.C., Environmental Engg., Laxmi Publications, 2005.
2. Garg S.K., Water Supply Engg., Khanna Publications, 2003.

D. Reference Books:

1. Peavy & Rowe, Environmental Engineering, McGraw Hill Publications, 2017.

E. Course Outcomes:

1. Students will be able to work understand the hygienic, safety and healthy environment.
2. Students will be able to design the various wastewater conveyance and the distribution systems.
3. Students will be able to deal with the various rural and urban sanitation system.

Subject Code: CE - 2203
Subject Name: Surveying - II
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1.To explore the advanced techniques in surveying.
2. To experience the different surveying methods such as triangulation and tacheometry.
3. To understand the basic of GPS, GIS, remote sensing, and total station.
4. To study different types of curves.

B. Course Content:

Levelling: Trigonometric levelling, Base of the object accessible, base of an inclined object accessible, R.L of an elevated points with inaccessible bases, Cross-sectioning, profile levelling, precise levelling, reciprocal levelling

Tachometry: Instrument used, Methods of Tacheometry, fixed hair method, movable hair method, range finding,

Triangulation: Principles of triangulation, Classifications, purpose, layout, Field work, Types of triangulation station

Curves: Types of curves, elements of curve, different methods of setting out-simple circular curves, compound curves, reverse curves, transition curves, types of transition curves, super- elevation, suitability of a circular curve, vertical curves.

Introduction to total station: Total Station and GPS: Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory, electromagnetic distance measuring system - principle of working and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

Introduction to GIS: Introduction – GIS definition, development, application areas. GIS Applications – Transportation, Water Resources, Environment, Geology, Emergency Management, Agriculture, Urban planning, climate change, Business.

Introduction to remote sensing techniques: Advantages of Remote Sensing over conventional surveying methods Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Image Processing - Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised. Applications: Geosciences, Water Resources, Land use – Land cover, Transportation Engineering, Image Interpretation.

C. Text Books:

1. Gopi S, Sathikumar R, Madhu N., Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, 2017.
2. Duggal S.K., Surveying Volume-II, Tata McGraw Hill Publisher, New Delhi, 2017.
3. Arora. K.R., Surveying Volume-II, Standard Publishers Distributors, 2019.

D. Reference Books:

1. Agor R., A Textbook of Surveying and Levelling, Khanna Publishers, New Delhi, 2015.
2. James B. C, Randolph H. W., Introduction to Remote Sensing, The Guilford Press, 2011.

E. Course Outcomes:

1. Understand the basic of triangulation and tacheometry
2. Understand the GPS, GIS, remote sensing, and total station
3. Have the knowledge on various types of curves

Subject Code: MH-2201
Subject Name: Entrepreneur Essential and Early-stage Start-up
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

The course is designed to meet the objectives of:

1. To involve themselves in the business activities
2. Starting innovative practices in their entrepreneurial activities.
3. Developing theirs kills on the traits that they want to carry forward.

B. Course Content:

Introduction to Entrepreneurship Meaning, Role of Entrepreneur, Entrepreneur Process: different approaches, Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices, Motivation for becoming an Entrepreneur. SME Concept, its role, status, prospects and policies for promotion of SMEs. Importance of Entrepreneurship: innovations, Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Issues & Problems Entrepreneurial Practices. Identifying and Assessing the Idea, Identifying Target Segment & Market Sizing, Analysing Environment & Competitive Advantage, Choosing the right legal structure, Permits, Registrations & Compliances, Components of a Business Plan, Creating an Effective B-Plan Part, Valuation, Investor pitch. Importance of Entrepreneurship: Entrepreneurship and Innovations, Converting Innovation to Economic Value which includes, Growth Strategies, value position, Market Segments, Value Chain Structure, Revenue Model, Contribution of Entrepreneurs: Towards R&D, creates Wealth of Nation & Self prospect with Challenge. Characteristics of Entrepreneurship idea generation techniques, Concept of product development, Business plan, Strategic Plan, issues and opportunity of early stage start-up etc.

C. Text Books:

1. Donald F. Kuratko, Entrepreneurship: Theory, Process, Practice Cengage Learning 2017
2. Desai, Vasant, Small Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi.2008
3. Kaulgud, Aruna Entrepreneurship Management. Vikas Publishing House, Delhi.2003
4. Cynthia, L. Greene. Entrepreneurship Ideas in Action. Thomson Asia Pvt. Ltd., Singapore. 2004

D. Reference Books:

1. Barringer Entrepreneurship: Successfully Launching New Ventures, Pearson Education

Publishing 2015

2. Timmons, Jerry A., and Spinelli, Stephen, New Venture Creation: Entrepreneurship for the 21st Century, 8th Edition, Boston, MA: Irwin McGraw-Hill 2009.
3. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001

E. Programme Outcomes:

1. Start the venture more scientifically.
2. Start the venture by linking with the financial institutions.
3. Seeking for a start-up idea
4. To be an entrepreneur

Subject Code: CE-2204
Subject Name: Transportation Engineering Laboratory - I
Credit Point: 1 (L=0, T=0, P=2)

A. Course Objectives:

1. Students will have idea about the strength of aggregates.
2. Students will have idea about the strength of subgrade soil.
3. Students will have idea about the effect of temperature on the bitumen.

B. Course Content:

1. To determine the impact value of aggregates.
2. To determine the crushing value of aggregates.
3. To determine the flakiness and elongation index of aggregates.
4. To perform Los Angeles and test on aggregates.
5. To determine the CBR value of a given soil sample.
6. Determination of softening point of bitumen.
7. Determination of penetration value of bitumen.
8. Determination of ductility value of bitumen.

C. Text Books:

1. Khanna K S., Justo C E G., Veeragavan A., Highway Engineering, Nem Chand & Bros, 2020.
2. Kadiyali R. L., Transportation Engineering, Khanna Publishers, 2021.
3. Venkatramiah C., Transportation Engineering (Highway Engineering), Orient Blackswan private limited, 2015.

D. Reference Books:

1. Papacostas S C., Prevedouros D P., Transportation Engineering, PHI publishers, 2016.
2. Chakroborty P. and Das, A., Principles of Transportation Engineering, PHI publishers, 2020.

E. Course Outcomes:

1. An ability to determine the engineering properties of aggregates.
2. An ability to determine the suitability of bitumen to be used in surface course.
3. Ability to find out the total thickness and thickness individual layer of a pavement by CBR test.

Subject Code: CE - 2205
Subject Name: Surveying Laboratory - II
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. To study the basic information about the equipment used in surveying.
2. To understand the tacheometric and trigonometric surveying.
3. To set out curves in the field.
4. To understand the total station and GPS.

B. Course Content:

1. To study the parts and working of a theodolite.
2. To measure the horizontal angles between the given stations about the instrument station as the vertex by the method of repetition.
3. To measure the horizontal angles between the given stations about the instrument station as the vertex by the method of reiteration.
4. To determine the vertical angle and the height of the pole at the same level as that of instrument with the help of theodolite
5. To measure the height and distance by Trigonometric levelling, when the base is inaccessible
6. To determine the constant of a given Tacheometer
7. Measurement of horizontal distance and vertical height using Tacheometer
8. Curves setting using long chord method
9. Introduction to GPS

C. Text Books:

1. Punmia, B.C, Jain A. K, Jain A.K., Surveying Volume-I & II, Laxmi Publications, 2016.
2. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.

D. Reference Books:

1. James A, Edward M, Surveying Theory and Practice, Tata Mc Graw Hill, 2012.
2. Charles D.G., Paul R.W., Elementary Surveying, Prentice Hall, 2014.

E. Course Outcomes:

1. Understand the usage of theodolite.
2. Explore the tacheometric and trigonometric surveying.
3. Set out curves in the field.
4. Have basic knowledge on GPS.

Subject Code: CE-2206
Subject Name: Structural Engineering Laboratory
Credit Point: 1 **(**L=0, T=0, P=2)

A. Course Objectives:

1. To find out the B.M and shear force in beams.
2. To study the behaviour of column under buckling for different material and end conditions
3. To study the behaviour of three hinged arch and suspension bridge
4. To find the member force in truss.

B. Course Content:

1. Bending Moment and Shear force in Beams Loaded with concentrated forces.
2. Experimental investigation of a symmetrical or unsymmetrical three hinged arch under loading.
3. Deflection of trusses under loads.
4. Various forms of buckling by Euler strut theory.
5. Determination of the buckling force for the case of an elastic joint and elastic fixed end support.
6. Demonstration of the behaviour of a typical suspension bridge.
7. Measurement of the bar forces in various single plan trusses.
8. Determine of elastic line under different loads and under different support condition.
9. Distribution of forces in trusses.
10. Buckling behaviour of bars of different materials.
11. Verification of stress hypothesis.
12. Deformation of bars under bending or torsion.
13. Experimental investigation of a parabolic arch under loading.

C. Text Books:

1. Punmia, B. C., Jain, A. K., Jain, A. K., Strength of Materials and Theory of Structures, Laxmi Publications, 1992.
2. Wang C, Chu-Kia. Intermediate structural analysis. McGraw-Hill Publishers, 2017.

D. Reference Books:

1. Jain A, Reddy S., Basic Structural Analysis, Tata McGraw-Hill Education, New Delhi, 1994.
2. Norris, C. H., Wilbur, J. B., Utku, S., Elementary structural analysis. McGraw-Hill Science, 1976.
3. Neal, B. G., The plastic methods of structural analysis, Chapman and Hall, 1966.

E. Course Outcomes:

1. Students will know about the behaviour of column under buckling load.
2. Students will have knowledge about the nature of forces in truss.
3. Students will have knowledge about the three hinged arch, suspension bridge.

Elective II

Subject Code: CE-220A
Subject Name: Fluid Mechanics - II
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To understand the flow classification open channels
2. To design the channels
3. To compute the flow profiles is channels
4. To study the basics about hydraulic machineries

B. Course Content:

Uniform Flow in Open Channels: Velocity distribution, Specific energy, Critical flow, critical depth, normal depth, sequent depth, types of flow, Channel transitions – change in depth and width, Uniform flow equations, design of channels

Steady Gradually Varied Flow: Differential equations, gradually varied flow equation, flow profile classification, Computation of GVF profiles – Direct step method and standard step method.

Steady Rapidly Varied Flow: Critical, Sub-critical and Super-critical flow, Hydraulic jump – equation, location of jump, classification of jump, Specific force, Computation of energy loss, flow over sharp and broad crested weir.

Unsteady Flow: mass and momentum equations - St. Venant's equations, Waves and their classifications, Celerity of a wave, surge formation – positive and negative surges.

Hydraulic Machinery: Classification of hydraulic machines, Design of Pelton turbine, Design of Francis turbine, Design of centrifugal pump, Design of a Kaplan turbine/ axial flow pump, Selection of hydraulic machines.

C. Text Books:

1. Chow V.T., Open Channel Hydraulics, Blackburn Press , 2009.
2. White F M., Fluid Mechanics, Tata McGraw Hill Publications, 2011.
3. Subramanya, K., Flow in Open Channel, Tata McGraw Hill Publications, New Delhi, 2019.

D. Reference Books:

1. Robert W. Fox Ogukuo H. Orutcgardm Alan T. McDonald, Introduction to Fluid Mechanics, Wiley India Edition, 2011.
2. Srivastava R, Flow through open channels, Oxford University Press, New Delhi, 2008.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons, New York, 2005.

E. Course Outcomes:

1. Study the flow classification in open channels.
2. Design of open channels.
3. Compute the flow profiles in open channel.
4. Solve the flow in hydraulic jump and surges and design of hydraulic machines.

Subject Code: CE – 220B
Subject Name: Computational Fluid Dynamics
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To analyse the turbulent flow.
2. To provide fundamental knowledge on finite difference/element and volume methods.
3. To describe the solution methodologies for discretized equations.

B. Course Content:

Derivation of flow governing equations; turbulence modelling; modeling approaches for multiphase flow; initial and boundary conditions; wellposedness.

Discretization of the governing equations using finite difference/volume/element methods; concepts of consistency, stability, and convergence; template for the discretization of a generic unsteady transport equation.

Solution of discretized equations; direct methods; classical iterative methods; advanced methods for structured matrices; conjugate gradient techniques; multigrid methods.

Solution of coupled equations: methods for compressible flows; evaluation of pressure in incompressible flows; pressure-velocity coupling algorithms.

Structured and unstructured grids; structured grid generation; unstructured grid generation. Benchmarking; calibration.

C. Text Books:

1. Wendt J. F., Computational Fluid Dynamics: An Introduction, Springer Science and Business Media, 2013.
2. Wesseling P., Principles of Computational Fluid Dynamics, Springer series, 2009.
3. Date A.W., Introduction to Computational Fluid Dynamics, Cambridge, 2005.

D. Reference Books:

1. Anderson J., Computational Fluid Dynamics, McGraw-Hill Education, 1999.
2. Hisch C., Numerical computation of internal and external flows, Elsevier, 2007.

E. Course Outcomes:

1. Develop knowledge on non-linear problems.
2. Improve knowledge on finite element, difference, and volume methods.
3. Provide solution methodologies for real time problems.
4. Develop hydrological and hydrodynamic models.

V Semester						
Sl. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-3101	Design of RCC Structures - I	3	0	0	3
2	CE-3102	Geotechnical Engineering - I	3	0	0	3
3	CE-3103	Concrete Technology	3	0	0	3
4	CE-310A / CE310B	Railway, Airport and Harbour / Traffic Engineering	3	0	0	3
5	CE-310X	OE3*	3	0	0	3
6	CE-3104	Internship-I	0	0	0	1
7	MH-3101	Engineering Economics	3	0	0	3
8	CE-3105	Minor Project-I	0	0	4	2
9	CE-3106	Geotechnical Engineering Laboratory - I	0	0	2	1
10	CE-3107	Concrete Technology Laboratory	0	0	2	1
11	CE-3108	Environmental Engineering Laboratory - I	0	0	2	1
Contact Hours			18	0	10	
Total Credits						24

Subject Code: CE-3101
Subject Name: Design of RCC Structures - I
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To study the stress strain behaviour of steel and concrete.
2. To understand the concept of working stress and limit state methods.
3. To gain the knowledge of limit state design for flexure, shear, torsion, bond, and anchor
4. To understand the behaviour of columns subjected to eccentric load and use of interaction diagrams.
5. To study the design of RC footings in foundation system.

B. Course Content:

Review of Concrete making materials- Structural concrete- Grades- properties of Concrete- Modulus of elasticity-flexural strength-Characteristic and Design Values- Partial safety factor- Design codes and specifications, Loads, Serviceability, Safety, design basis, Strength design, Allowable stress design, Safety provisions, Required strength, Design strength.

Methods of design - Aims of design- RCC- Limit State method- Assumptions- Stress-Strain behaviour of Steel and Concrete- Stress block parameters- Working stress method-comparison of design process.

Design of Singly Reinforced Beams - Analysis of Singly Reinforced RC Section-Neutral Axis-Balanced-Under Reinforced-Over Reinforced Sections- Moment of Resistance- Design parameters- Design examples.

Design of Doubly Reinforced Beams - Necessity of Doubly Reinforced sections-Analysis of Doubly Reinforced RC Section-Moment of Resistance- Design parameters-Design.Shear and Bond design of RCC - Shear forces in RC-Shear Resistance of RC-Truss analogy- design of Vertical Stirrups-Bent-up bars- Limitation- Bond failure in RC- Check for bond resistance-Development Length-Design for shear and bond.

Design of Flanged Beams - Analysis of flanged RC section- Singly and Doubly Reinforced-Effective flange width- Moment of Resistance- design examples.

Design of RCC Slabs - Design of One- and Two-way slabs- Effect of edge conditions-Moment of resistance-Torsion reinforcement at corners- Design examples.

Design of Continuous Slab and Beams - Effect of continuity- analysis of continuous beam/slab- Moment and shear coefficients for continuous beam/slab- Critical sections.

Design of RC Columns - Design principles of RC columns- Assumptions- Rectangular and Circular columns- Helical reinforcement- Minimum Eccentricity-Use of Interaction diagrams for Axial load and Moment.

Design of RC Footings - RC footings-Minimum depth of footing- Safe bearing capacity-Design for Bending-Shear in One way and Shear in Two way- Transfer of load at base of column.

Design for Serviceability - Concept of Serviceability- Deflection- Span to depth ratio-short term-long term deflection due to Shrinkage, Creep- Cracking-Crack width calculation.

Design of Miscellaneous RC Structures - Design of Stair case, lintels/chazzas, parapets

C. Text Books:

1. Varghese, P. C., Limit state design of Reinforced Concrete. PHI Learning Pvt. Ltd., 2008.
2. Punmia, B. C., Jain, A. K., Jain, A. K., Limit state design of reinforced concrete., Laxmi Pub. Pvt Ltd, 2016.
3. BIS IS 456: Plain and Reinforced Concrete Code of Practice, 2000.

D. Reference Books:

1. Unnikrishna P.S, Reinforced Concrete Design, McGraw Hill Pub, 2009.
2. Narayanan S., Design of reinforced concrete structures. Oxford University Press, 2013.
3. Park, R., Paulay, T., Reinforced Cement Concrete Structures, Wiley India Pvt. Ltd, 2009.

4. Krishnaraju, N., Design of reinforced concrete structures, IS:456-2000, CBS Publications, 2019.

E. Course Outcomes:

1. Design the Reinforced Concrete beams using limit state and working stress methods.
2. Design Reinforced Concrete slabs.
3. Design the Reinforced Concrete Columns and footings.
4. Design structures for serviceability.
5. Design stair cases and other minor structural elements of a RC building

Subject Code: CE-3102
Subject Name: Geotechnical Engineering - I
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To have impart the knowledge about the origin of soil.
2. To know how to classify the soil.
3. To have idea about the soil, air water relationship
4. To have idea of the different properties of soil
5. To inculcate research directions in the field of Geotechnical Engineering.

B. Course Content:

Origin, Index Properties and Classification: Identification and classification of soils, Index properties, phase relationship, consistency, sensitivity, clay mineralogy, IS Codal provisions for assessing various index properties.

Permeability and Seepage: Darcy's law of permeability, Determination of Coefficient of permeability, IS Codal provisions for assessing permeability, Equivalent permeability for stratified soil, Flow nets – principles, construction and application, Effective stress analysis, quick sand condition, piping, filtration criteria.

Effective stress and Stress Distribution: Effective stress and pore-water pressure, Effective stresses during drained and undrained condition, Capillarity in soils. Stress distribution due to surface loads: Boussinesq and Westergaard analysis for point loads, Line loads, strip loads; Stresses beneath a circular, rectangular and irregular shaped foundations, Stress distribution by 2:1 theory, Pressure isobars.

Compaction: Principle of compaction, Light and heavy compaction, field compaction control, factors affecting compaction, effect of compaction on soil properties.

Compaction of cohesionless soil, relative density, IS Codal provisions for assessing compaction.

Compressibility and Consolidation: Terzaghi's theory of one-dimensional consolidation, Secondary Consolidation, Consolidometer, Assessment of various consolidation parameters through laboratory test and results (Cc, Cv, mv, av, e-p and e-log p), assessment of preconsolidation pressure from consolidation test, estimation of consolidation settlement due to primary and secondary compression, introduction to two- and three-dimensional consolidation, IS Codal provisions for assessing consolidation.

Shear Strength of Soil: Strength envelope, Mohr's circle of stresses, total and effective stress paths, pore pressure, evaluation of shear strength parameters by direct shear, triaxial shear, vane shear, and unconfined compression strength tests, IS Codal provisions for assessing various shear strength properties.

C. Text Books:

1. Ranjan G., Rao A S R., Basic and applied soil Mechanics, New age international Punlishers, 2016.
2. Punmia B.C., Jain K A., Soil Mechanics and foundations, Laxmi Publishers, 2017.
3. Murthy V N S P., Geotechnical Engineering, UBS punlishers, 2019.

D. Reference Books:

1. Arora K.R., Soil Mechanics and Foundation Engineering, PHI publishers,2016.
2. Das M. B., Fundamentals of Geotechnical Engineering, Cengage learning, 2010

E. Course Outcomes:

1. Students will have idea about the basic Soil Mechanics.
2. Special terminology related to soil mechanics will be clear.
3. Students will be able to efficiently deal with the problems of seepage.
4. Will have idea about the compressibility, consolidation and shear strength characteristics of soil.

Subject Code: CE-3103
Subject Name: Concrete Technology
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. Identify Quality Control tests on concrete making materials.
2. Understand the behaviour of fresh and hardened concrete.

3. Design concrete mixes as per IS codes.
4. Understand the durability requirements of concrete.
5. Understand the need for special concretes.

B. Course Content:

Concrete Making Materials: Cement, Fine Aggregate, Coarse aggregate, Water, Chemical & Mineral admixtures. Hydration of Cement: Bogue's compounds, Hydration, Gel formation, Types of cement, pore & capillary water. Quality tests on cement: Different test on cement as per Indian standards Aggregates: Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis – Grading. Fresh concrete: Properties of fresh concrete- Workability – different tests of workability Factors influencing workability compaction, finishing, curing. Hardened concrete: Tests on hardened concrete as per IS codes – Relationship between different strengths – factors influencing strength, NDT techniques.

Durability: Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack. Concrete Mix design: Different methods of mix design – factors affecting mix design – exercises. Admixtures - accelerating admixtures - Retarding admixtures - water reducing admixtures - Air entraining admixtures - coloring agent - Plasticizers. Batching - Mixing -Transportation - Placing of concrete - curing of Concrete

Strength of Concrete - Shrinkage and temperature effects - creep of concrete - permeability of concrete - durability of concrete - Corrosion - Causes and effects - remedial measures Thermal properties of concrete - Micro cracking of concrete. Special Concrete - lightweight concrete - Fibre reinforced concrete - Polymer-polymer modified concrete - Ferrocement - Mass concrete - Ready mix concrete- Self compacting concrete- Quality control - Sampling and testing-Acceptance criteria.

C. Text Books:

1. Shetty M. S., Concrete Technology, S Chand Co., Publishers, 2006.
2. Gambhir M. L., Concrete Technology, Tata Mc Graw Hill Publishers, 2012.

D. Reference Books:

1. Bungey J.H., Testing of Concrete in Structures, Surrey University Press, New York, 2011.

E. Course Outcomes:

1. Know the mix design and nominal design methods.
2. Able to prepare different concrete grade.
3. Able to distinguish the field or onsite good properties of the building materials.

4. Will know different testing methods to characterise the building material.

Subject Code: MH-3101
Subject Name: Engineering Economics
Credit Point: 3 (L=3, T=0, P=0)

A. Course objectives:

The course is design to meet the following objectives:

1. Learn the fundamentals of Engineering Economics
2. Understand and use of Economic concepts in making business decision
3. Use economic information to manage the organization
4. Use economic tools with respect to acceptance or rejection of investment proposals
5. Know the current issues relating to economic environment

B. Course content

Basics of Economics: Basic Concepts, Scope, Importance and definitions, Relevant to Managerial Economics-Factors Influencing Managerial Decision — Managerial economics and other disciplines, Relation between Science, Engineering, Technology and Economics Demand Analysis : Managerial Decisions-Meaning-Types—Determinants, Demand Functions, Demand Elasticity, Demand Forecasting Methods, Accuracy of Forecasting Cost concept :Costs Concepts-Accounting Cost and Economic Cost determinants of Cost, Cost —Output Relationship, Break Even Analysis- Meaning, Assumption, Uses and Limitation, Break Even Point (BEP)- Meaning, Determinants of Break Even Point- Break Even Charts, linear approach (Simple numerical problems to be solved). Market Structure and Product Pricing: Perfect and Imperfect Market Structures. Conditions of Perfect Competition. Price of a Product under demand and supply forces. Equilibrium Price. Pricing under Monopoly and Monopolistic Competition. Pricing under Oligopoly. Kinked Demand Curve. Discriminating Prices. Inflation, Business cycle, Nation alI income: Inflation- meaning, feature, Types, causes, Effects of Inflation, Measures to Control Inflation. Business Cycle - Features of Business Cycle, Causes of Business Cycle, Types of Business Cycle, Theories of Business Cycle, Impacts/ Effects of Business Cycle, Measures to Control Business cycle, National Income & Current Issues-Concepts of National Income, Factors Determining Level (Size)of National Income, Methods of Measurement of National Income, Choice of Methods of National Income, Importance of Measurement of National Income, Difficulties in Measuring National Income.

C. Text Books:

1. Park, S. Chan, Fundamentals of Engineering Economics, Fourth Edition, Pearson New York, 2019
2. Yates, J.K. Engineering Economics, 1st Edition, CRC Press, Boca Raton, 2016.
3. Brajesh Kumar, Zahid A.Khan, Arshad N. Siddiquee, Mustufa H. Abidi , Principles of Engineering Economics with Applications, Cambridge University Press; 2nd edition 2018
4. Singh, Seema, Economics for Engineering Students, Second Edition. I.K. International Publishing House, Delhi, 2014.

D. Reference Books:

1. Panneer Selvam, Engineering Economics, Second Edition, New Delhi, PHI Learning Private Limited, 2013.
2. Pravin Kumar, Fundamentals of Engineering Economics, New Delhi, John, and Wile y, 2012.
3. Gupta, G.S. Managerial Economics, Joel Dean, Englewood Cliffs, N.J.: Prentice-. Hall, 2011
4. Diwedi, D.N., Managerial Economics, New Delhi, Pearson Education India, 2012. 5. Varshney, S.C., Managerial Economics, New Delhi Sultan Chand & Sons, 2010

E. Course Outcomes:

1. Learn the fundamentals of Engineering Economics.
2. Understand and use of Economic concepts in making business decision.
3. Use economic information to manage the organization.
4. Use economic tools with respect to acceptance or rejection of investment proposals.
5. Know the recent trends relating to economic environment.

Subject Code: CE-3106
Subject Name: Geotechnical Engineering Laboratory - I
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Students would learn to classify soils and find out their index properties
2. Students will have knowledge of permeability of soil
3. Students would have the idea of compaction and consolidation tests of soils
4. Students will have idea about stress and strain of soil
5. Student would have the idea to assess the strength of soils through various tests

B. Course Content:

1. Visual classification of soils

2. Determination of moisture content
3. Determination of specific gravity
4. Grain size analysis
   i. Sieve analysis ii. Hydrometer analysis
5. Determination of consistency limits (Liquid limit, Plastic limit and Shrinkage Limit)
6. Permeability test
   i. Falling head method ii. Constant head method
7. Proctor Compaction test
8. Direct shear test
9. Unconfined compression test
10. Consolidation test
11. Triaxial test (UU)

C. Text Books:

1. Ranjan G., Rao A S R., Basic and applied soil Mechanics, New age international Punlishers, 2016
2. Punmia B.C., Jain K A., Soil Mechanics and foundations, Laxmi Publishers, 2017
3. Murthy V N S P., Geotechnical Engineering, UBS punlishers, 2019
4. Fratta, Aguettant, Smith – Introduction to Soil Mechanics Laboratory Testing, CRC Press, 2007

D. Reference Books:

1. Arora K.R., Soil Mechanics and Foundation Engineering, PHI publishers, 2016.
2. Das M. B., Fundamentals of Geotechnical Engineering, Cengage learning, 2010.

E. Course Outcomes:

1. An ability to classify the soil according to Indian standards.
2. An ability to find out the engineering properties of the soil like MDD, OMC etc
3. Idea about the seepage and permeability of soil
4. Settlement and consolidation characteristics of soil

Subject Code: CE-3107
Subject Name: Concrete Technology Laboratory
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. Various Strength test on concrete to be performed
2. Aggregate quality test for building purpose

3. Read to test different parameters of cement, fine and coarse aggregate and test the non-destructive equipment
4. Make concrete based on mix design.

B. Course Content:

1. Determination of Fineness and Specific Gravity of cement.
2. Determination of consistency of standard Cement Paste.
3. Determination of initial and Final Setting times of Cement.
4. Determination of Compressive Strength of Cement.
5. Determination of Fineness modulus of Coarse and Fine Aggregates.
6. Determination of Percentage of Voids, Bulk Density, Specific Gravity of Coarse and Fine Aggregates.
7. Preparing and curing concrete specimen for tests and determination for compressive strength of concrete cubes.
8. Study of stress-strain characteristics of concrete and tests for tensile strength of concrete.
9. Experiment to demonstrate the use of non-destructive test equipment.
10. Mix Design

C. Text Books:

1. Nevill A.M., Properties of Concrete, Prentice Hall Publishers, 2012.
2. Shetty M. S., Concrete Technology (theory and practical), S Chand Co., Publishers, 2006.
3. Gambhir M. L., Concrete Technology, Tata Mc Graw Hill Publishers, 2012

D. Reference Books:

1. Bungey J.H., Testing of Concrete in Structures, Surrey Univ Press, New York, 2011.
2. Hemant Sood, L. N Mittal, P.D Kulkarni, Laboratory Manual on Concrete Technology CBS Publishers & Distributors, 2016

E. Course Outcomes:

1. Students will be confidence in supervise in the concreting operations involving proportioning, mixing, transporting, placing, compacting and curing of concrete.
2. Will have better understanding of the role of concrete technology in the construction world.

Subject Code: CE-3108
Subject Name: Environmental Engineering Laboratory -I
Credit Point: 1 (L=, T=0, P=2)

A. Course Objectives:

1. Lean to determine the physical, chemical, and biological properties of water
2. Learn to work in laboratory environments

B. Course Content:

1. Determination of pH.
2. Determination of Conductivity.
3. Determination of Acidity of water and Alkalinity of water
5. Determination of Chloride content.
6. Determination of Hardness of water.
7. Determination of Fluoride content.
8. Determination of Available Chlorine in bleaching powder.
9. Conducting Break Point Chlorination Test.
10. Determination of Residual Chlorine.
11. Determination of Dissolved Oxygen.
12. Determination of Chemical Oxygen Demand.
13. Determination of Biochemical Oxygen Demand.
14. Conducting Jar test for determining optimum dosage of coagulant.
15. Determination of Total Solids, Total Dissolved Solids & Settleable Solid.

C. Text Books:

1. Garg S.K., Water Supply Engg., Khanna Publications, 2003.
2. Kotaiah, B., Swamy, K.N., Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 2007.

D. Reference Books:

1. Sawyer, C. N., McCarty, P. L., Perkin, G.F., Chemistry for Environmental Engineering and Science, McGraw-Hill Inc., 2002.

E. Course Outcomes:

1. Determine physical, chemical, and biological characteristics of water and wastewater.
2. Determine optimum dosage of coagulant.
3. Determine break - point chlorination.
4. Assess the quality of water and wastewater.

Elective - III

Subject Code: CE-310A
Subject Name: Railway, Airport and Harbour
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. An ability to design runaway and to calculate the airport capacity.
2. Knowledge of airport pavement design.
3. An ability to know the railway tracks, stresses in rails, track alignment
4. To have a wide idea of the urban transportation system.
5. To have knowledge of basic concept of Airport Engineering.
6. To have knowledge of basic concept of Railway Engineering.
7. To have a basic knowledge of the harbour systems.

B. Course Content:

Permanent Way and Components: History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation, – functions requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications.

Track Geometrics, Turnouts and Crossings, Stations and Yards: Railway alignment, vertical alignment- gradients and grade effects, horizontal alignment-horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings-terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings.

Different types of stations and Yards: classification and functioning.

Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas.

Introduction to Airport Engineering: Aircraft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment.

Water Transport Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Inland waterways: advantages and disadvantages; Development in India, Inland water operation

C. Text Books:

1. Chandra S., Agarwal M., Railway Engineering, Charotar Publishing, 2015.
2. Gupta B.L., Gupta A., Railway Engineering, Stanadard Publishers, 2005.
3. Rangwala S C., Airport Engineering, Chorator publishing house, 2013.
4. Norman J. A., Mumayiz S, Wright P H., Airport Engineering: Planning, Design and Development of 21st Century Airports, Wilwy and sons, 2016.

D. Reference Books:

1. Papacostas S C., Prevedouros D P., Transportation Engineering, PHI publishers, 2016.
2. Chakroborty P., Principles of Transportation Engineering, PHI publishers, 2020.

E. Course Outcomes:

1. An ability to transport system management.
2. An ability to design runaway and to calculate the airport capacity.
3. A knowledge of airport pavement design.
4. An ability to know the railway tracks, stresses in rails, track alignment.

Subject Code: CE-310B
Subject Name: Traffic Engineering
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. An ability to design the road with existing traffic capacity of the town /city.
2. Ability to calculate the traffic flow, traffic volume of the town/city.
3. Idea about the traffic signs.

B. Course Content:

Introduction to traffic analysis, operation and control including traffic capacity anlaysis, components and characteristics traffic system, statistical application in traffic operation, Design of Intersections, Basics of traffic signal design and phase timing, analysis and design of pre-timed and phase timing, traffic modeling including computer applications. Signal coordination for arterials and networks, Arterial analysis planning and Design,

Analyisis of unsignalized intersections, Design of parking facility, Highway Lighting, Traffic planning and administration studies and their uses, traffic flow characteristics, traffic control devices, intersections, traffic planning, Trip generation models, trip distribution models, modal split analysis. Advanced methods for travel demand forecasting.

C. Text Books:

1. Roess R.P., Prassas S.E, Mc- Shane W.R., Traffic Engineering, Prentice Hall, 2011.
2. Khanna K S., Justo C E G., Veeragavan A., Highway Engineering, Nem Chand & Bros, 2020.

D. Reference Books:

1. Papacostas S C., Prevedouros D P., Transportation Engineering, PHI publishers, 2016.
2. Chakroborty P., Principles of Transportation Engineering, PHI publishers, 2020.

E. Course Outcomes:

1. Knowledge of achieving efficient, free and rapid flow of traffic.
2. Knowledge of having fewer accidents and pedestrians should also be given importance.

VI Semester						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-3201	Engineering Hydrology	3	0	0	3
2	CE-3202	Design of Steel Structures - I	3	0	0	3
3	CE-3203	Geotechnical Engineering - II	3	0	0	3
4	CE-320A / CE-320B	Sustainable Construction and Green Manufacturing/ Design of RCC Structures - II	3	0	0	3
5	CE-321A / CE-321B	Environmental Engineering – II / Environmental Systems Design and Modelling	3	0	0	3
6	CE-320X	OE4*	3	0	0	3
7	CE-3204	Minor Project-II	0	0	4	2
8	CE-3205	Computer Applications in Civil Engineering	0	0	2	1
9	CE-3206	Civil Engineering Drawing	0	0	2	1
10	CE-3207	Geotechnical Engineering Laboratory - II	0	0	2	1
Contact Hours			18	0	10	
Total Credits						**23**

Subject Code: CE – 3201
Subject Name: Engineering Hydrology
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To provide knowledge on principles and processes governing the movement of water through the hydrologic cycle.
2. To analyse and estimate various components in hydraulic cycle.
3. To arrive rainfall-runoff model.
4. To understand the basic transport of sediment in rivers.
5. To understand the groundwater occurrence and movement.

B. Course Content:

Introduction to Hydrologic cycle, water budget equation, basic concepts of weather systems, characteristics of precipitation in India.
Precipitation: Weather system for precipitation, Characteristics of precipitation, Rain Gauge Network, Test for consistency of data, analysis of rainfall data, intensity-duration-frequency analysis, Depth-Area-duration relationship

Evaporation and Evaporation Process, measurement, estimation and control of evaporation, Evapotranspiration, measurement and estimation of evapotranspiration, interception and depression storage, Infiltration process, measurement of infiltration, infiltration models and infiltration indices and effective rainfall

Stream flow measurement: measurement of stage, measurement of velocity, area-velocity method, Stage-discharge relationship, extrapolation of rating

Runoff: Runoff characteristics of streams, flow-duration curve, flow-mass curve, runoff computation.

Hydrograph: Factors affecting flood hydrograph, Components of a hydrograph, Base Flow separation, effective rainfall, unit hydrograph, derivation of unit hydrograph, unit hydrograph of different durations, use and limitations of different hydrograph, Distribution graph, synthetic unit hydrograph

Floods: Estimation of peak discharge, rational method, SCS method and unit hydrograph method, Design flood, return period, flood frequency analysis, probabilistic and statistical concepts. Gumbel's and log Pearson Type III methods.

Flood routing: Basic Equations, hydrologic storage routing, attenuations, hydrologic channel routing, hydraulic method of flood routing, flood control.

Sediment transport in rivers: properties of the sediment, bed load, suspended load, total load, stable channels, riverbed variations, scour, measuring techniques

Groundwater: Occurrence of groundwater, types of aquifers, aquifer properties, Groundwater movement, Darcy's law, Conductivity and Transmissivity, yield from a well under steady state conditions, Pumping tests, unsteady flow in unconfined aquifers, well losses and specific capacity

Experimental demonstration: Infiltrometer, rainfall/ runoff relationships, investigation of groundwater flow, sediment transport through flume.

C. Text Books:

1. Subramanya, K., Engineering Hydrology, Tata Mc Graw Hill Pub. Co., New Delhi, 2017.
2. Chow, V. T., Maidment, Mays, L. A. Applied Hydrology, Tata Mc Graw Hill Pub. Co., New York, 2017.
3. Raghunath H.M, Ground Water Hydrology, New Age International (P) Limited, 2007.

D. Reference Books:

1. Viessman W, Lewis G. Introduction to Hydrology, Prentice Hall of India, 2003.
2. Ojha CSP, Berndtsson R., Bhuiya P., Engineering Hydrology, Oxford University Press Co., New Delhi, 2008.
3. Garde R J, River Morphology, New Age International Ltd, 2015.

E. Course Outcomes:

1. Understand the hydrological parameters.
2. Analyze the rain fall data and estimate the abstraction.
3. Solve the rainfall-runoff models and flood rooting problems.
4. Understand the sediment transport in rivers.
5. Understand the groundwater occurrence and movement.

Subject Code: CE-3202
Subject Name: Design of Steel Structures – I
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To understand the provisions of IS800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
2. To study the behaviour and design of compression and tension members using simple and built-up sections.
3. To understand behaviour of flexural members and the design laterally restrained and unrestrained beams.
4. To study the design of bolted and welded connections and arranging field visit to industries.

B. Course Content:

Introduction: General- Types of Steel – Mechanical behaviour of steel – Measures of Yielding – Measures of Ductility – Types of Structures – Structural Steel Sections.
Methods of Structural design - Introduction-Design Philosophies-Working Stress Method-Ultimate Strength Method-Load and Resistant factor- Limit State Method-Partial safety factor-Load-Load Combinations-Classification of Cross sections- General aspects in the design. Design of compression member, tension members, simple beams, columns and base plates using working stress method. Design of Steel fasteners - Types of fasteners – Riveted connections- Bolted Connections-Assumptions- Failure of bolted joints – Strength of bolted joints – Design examples – Design of Welded connections – Butt weld- fillet weld – Design examples. Design of Tension Members - General – Modes of Failure of Tension member- Analysis of Tension members- Example - Design steps – Design examples – Lug angles – Design. Design of Compression Members - General – Strength of Compression members- Design Compressive strength- Example on analysis of Compression members – Design of Angle struts – Design Examples- Built up Columns- Design of Lacing – Design of Battens- Design Examples- Design of

Roof members. Design of Beams - General- Lateral Stability of Beams- Bending Strength of Beams – Plastic Section Modulus - Design Examples.

C. Text Books:

1. Duggal, S. K., Limit state design of steel structures, Tata McGraw Hill Publishers, 2019.
2. Subramanian, N., Steel structures-Design and practice, Oxford University Press., 2018.

D. Reference Books:

1. Vazirani, V. N., Ratwani M.M., Design and Analysis of Steel Structures, Khanna Publishers, 1988.
2. Dayaratnam, P., Design of Steel Structures, S. Chand Publishers, 2012.
3. Negi, L. S., Design of Steel Structures, Tata Mc Graw Hill Publishers, 2017.
4. Bhavikatti, S. S., Design of Steel Structures (By Limit State Method as Per Is: 800 2007). IK International Pvt Ltd., 2019.
5. Standard, Bureau Indian. "General construction in steel-code of practice." 3rd Revision, Bureau of Indian Standard, New Delhi, India, IS (2007): 800-2007.

E. Course Outcomes:

1. Students will be confident in designing the steel structures.
2. Capable to analyze the load on the steel structures.
3. Will have clear idea about the welded, bolted, riveted connections.
4. Students should be capable of designing structures in steel and understand its structural behaviour.
5. Students will have idea about the design of structural steel elements – tension member, compression member, beam, and column. Students will know the role of steel in the Construction works.

Subject Code: CE-3203
Subject Name: Geotechnical Engineering – II
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Understand the concept of Foundation Engineering.
2. To be able to understand the bearing capacity of the soil.
3. To have knowledge of the various tests that can lead to the calculation of the bearing capacity of soil.
4. Students will be able to calculate the settlement of foundations.
5. To have the concept of site investigation and subsurface exploration.

B. Course Content:

Subsurface Investigation: Purpose of site investigation, Planning and execution of soil exploration and subsurface investigation; Borings methods and their types, Auger Boring, Wash boring, Percussion boring, Area ratio, Soil report, Soil profiling; Various types of subsurface explorations such as SPT, CPT (SCPT/DCPT), Pressuremeter/Dilatometer tests, Vane shear test, Plate load tests. Introduction to Geophysical explorations and their usage in subsurface exploration, Introduction to relevant IS Codes.

Shallow Foundations: Factors effecting locations of foundation and design considerations of shallow Foundations, Choice of type of foundations, Foundations on expansive soils.

Bearing Capacity of Shallow Foundations: Safe bearing capacity, allowable bearing pressure, Terzaghi's bearing capacity equation and its modifications for square, rectangular and circular foundation, General and local shear failure conditions, Factors affecting bearing capacity of Soil. Allowable bearing pressure based on values, bearing capacity from plate load tests, SPT and CPT; Introduction to relevant IS Codes.

Settlement analysis of Shallow Foundations: Types and causes of settlement, Computation of settlement (immediate and consolidation), allowable settlement, Introduction to relevant IS Codes, Measures to reduce settlement.

Pile Foundations (Bearing capacity and Settlement): Types, Construction, load carrying capacity of single pile Dynamic Formula, Static formula, Pile load tests, Load carrying capacity of pile groups in sands and clays, settlement of pile groups, Negative skin Friction, Uplift capacity of piles, Introduction to relevant IS Codes.

Caissons and Well Foundations: Types of caissons, pneumatic caissons, Different shapes of well foundations. Relative Advantages and disadvantages. Different Components of wells and their function. Grip length, problems in well sinking and remedial measures.

Earth Pressure: Types of Earth pressure. Rankine's Active and passive earth pressure, Smooth Vertical wall with horizontal backfill. Extension to Soil, Coulombs wedge theory, Culman's and Rebhann's graphical method for active earth pressure. Bulkheads Classifications, Cantilever sheet Piles in Sandy soils and clay soils. Analysis of Anchored bulkheads free earth support and fixed earth support methods.

Introduction to slope stability analysis: Finite and infinite slope stability analyses techniques in sands and clays, Different types of slip surfaces, Various methods of slices, factor of safety determination, Taylor's factor of safety charts, Morgenstern-Price tables, Rapid drawdown analysis

C. Text Books:

1. Ranjan G., Rao A S R., Basic and applied soil Mechanics, New age international Punlishers, 2016.
2. Punmia B.C., Jain K A., Soil Mechanics and foundations, Khanna Publishers, 2021.

D. Reference Books:

1. Arora K.R., Soil Mechanics and Foundation Engineering, PHI publishers,2016.
2. Das M. B., Fundamentals of Geotechnical Engineering, Cengage learning, 2010.

E. Course Outcomes:

1. Students will be expert in bearing capacity calculation.
2. Student will know the method to solve the settlement problems in foundations.
3. Ability to do site investigations and subsurface explorations.

Subject Code: CE-3205
Subject Name: Computer Applications in Civil Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To have knowledge of use of the different types of software in Civil Engineering.
2. To identify the problems faced by civil engineers in drawings and analysis to solve the same in the shorter duration with the aid of softwares.
3. To be expert in modelling, analysis, Designing and programming.

B. Course Content:

Introduction of Auto CAD - Limits, units, Grid, Snap, Osnap. Standard tool bars: Match properties, pan, zoom. Draw: Line, Pline, mline, Rectangle, polygard, Arc, Circle, Donut, Spline, Ellipse, Boundary, Hatch, Text, mtext. Modify/Edit: Erase, copy, Mirror, offset, array, move, rotate, scale, stretch, lengthen, trim, Extend, Break, Chamfer, fillet, Explode. Dimensioning: linear, aligned, Baseline, Continue, Radius, diameter, Angular, Style. Layer: New layer, current layer, freeze, lock, colour, line type, line weight, delete. View: UCS, view, View ports.3-D: Solid editing, Shade, render, 3d – orbit.

Preparation of a Building Plan, elevation and Section in Detail. Introduction to STAAD Pro software - Model generation, Analysis & Steel & Concrete design. Introduction to MATLAB -Matrix Operations, Colon Generators and submatrices, Common MATLAB commands, Programming in MATLAB. SAP 2000, GIS software (ArcGIS/QGIS/GrassGIS, whichever suitable) and HEC-RAS. Introduction on geotechnical software such Geostudio/PLAXIS/ Rocscience.

Introduction to Abaqus and Ansys.

C. Text Books:

1. Kirkpatrick, J.M., The AutoCAD (R) Book: Drawing, Modeling, and Applications Using AutoCAD (R), Prentice Hall Press, 2008.
2. Wohlers, T.T., Applying AutoCAD: A Step-by-step Approach for AutoCAD, McGraw-Hill, 1995.
3. Naganathan S., Learn Yourself STAAD.Pro V8i: Structural Analysis and Design using STAAD.Pro V8i, Lambert academic publication, 2012.
4. Higham, D.J., Higham N.J., MATLAB guide. Society for Industrial and Applied Mathematics, 2016.

D. Reference Books:

1. Omura G., Mastering AutoCAD, John Wiley & Sons, 2012.
2. Hamad M, Using STAAD Pro 2006, Shroff, 2006.

E. Course Outcomes:

1. Student should have a clear idea to use the civil engineering related softwares.
2. Drawings can be made with the help of AutoCAD in shorter duration.
3. Students will be expert in modelling, analysis, Designing and programming.

Subject Code: CE-3206
Subject Name: Civil Engineering Drawing
Credit Point: 1 (L=0, T=0, P=2)

A. Course Objectives:

1. To understand the principles of planning and bylaws.
2. To draw plan, elevation and section of public and industrial load bearing and framed structures.
3. To draw plan, elevation and section of public and industrial structures.
4. To prepare detailed working drawing for doors, windows, etc

B. Course Content:

Classification of buildings - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio - Orientation of buildings - Lighting and Ventilation. Planning and preparing sketches and working drawings of Residential buildings and Industrial buildings. General arrangement drawing of Civil engineering structures-

Buildings, Bridges, Retaining wall, Dams, Pipelines, Water tanks etc. with design notations. Plans, elevations, and sectional view of Civil engineering structures. Different types of staircases. Typical detailing of beams, columns, and foundations.

C. Text Books:

1. Punmia, B. C., Jain, A. K., Jain, A. K., Building Construction, Laxmi Publication, 2016.
2. Arora S. P., Bindra S. P., The Text book for Building Construction, Dhanpat Rai Publications, 2010.

D. Reference Books:

1. Varghese P.C., Building Construction, PHI Learning Pvt. Ltd., 2017.
2. Bureau of Indian Standards, National Building Code of India, 2016.
3. Carandang, L. Autocad Manual. Rex Bookstore, Inc.

E. Course Outcomes:

1. Create, analyse, and produce 2D drawings manually.
2. To study and understand civil engineering drawings.
3. Draw the plan, section and elevation of a building.
4. Detailing building plans in CAD environment.

Subject Code: CE-3207
Subject Name: Geotechnical Engineering Laboratory - II
Credit Point: 1 (L=0, T=0, P=2)

A. Course Objectives:

1. Determine the shear strength of the soil.
2. Know the various site investigation tests.

B. Course Content:

1. Determination of the shear strength of soil sample by vane shear test
2. Determination of relative density of soil by vibration table method
3. Determination of field density of soil by sand replacement method/ core cutter method
4. Determination of soil electrical resistivity.
5. Determination of liquid limit of soil by cone penetration method
6. Determination of SPT value
7. Determination of shear strength parameters of soil by direct shear test (Digitised)
8. Determination of shear strength parameters by Triaxial test

a. UU test
b.CU test
c. CD test

9. Determination of sub-surface profile by MASW test.

C. Text Books:

1. Ranjan G., Rao A S R., Basic and applied soil Mechanics, New age international Punlishers, 2016.
2. Punmia B.C., Jain K A., Soil Mechanics and foundations, Laxmi Publishers, 2017.
3. Murthy V N S P., Geotechnical Engineering, UBS punlishers, 2019.

D. Reference Books:

1. Das M. B., Fundamentals of Geotechnical Engineering, Cengage learning, 2010

E. Course Outcomes:

1. An ability to determine the shear strength of soil.
2. An ability to determine the relative density of soil
3. Knowledge of filed investigation test to find out the subsoil profile.

Elective - IV

Subject Code: CE-320A
Subject Name: Sustainable Construction and Green Manufacturing
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To explain the importance of sustainable built environment.
2. To emphasis the significance of sustainable development and construction.
3. To introduce the techniques and for assessing environmental impact.
4. To perform the service life and life cycle assessments.

B. Course Content:

Introduction - Sustainability and resources, need, present practices at national and international level, The Sustainability Quadrant- challenges & Issues, Government initiatives. Construction Product, Process Design and Development- Sustainability of construction resources, process modifications, product performance evaluation. Sustainability assessment using standard approaches- Leadership in Energy and Environmental Design (LEED)/ Green Rating Integrated Habitat Assessment (GRIHA) rating evaluation process. Socio-economic feasibility of sustainable construction products- Innovative & customized sustainable product design based on social constraints; tools & aids available for sustainable construction products. Life Cycle

Assessment and Costing-Various aspects related to construction cost, present value analysis, life cycle stages, cost calculation & measures, evaluation criteria, uncertainty assessment, sensitivity analysis, break even analysis.

C. Text Books:

1. Horne R. E., Grant T., Verghese K., 'Life Cycle Assessment: Principles, Practice and Prospects', CSIRO, 2009.
2. Karli Verghese, Helen Lewis, Leanne Fitzpatrick, 'Packaging for Sustainability', Springer, 2012.
3. Jain, A. K. "The Idea of Green Building.", Khanna Publishers, 2014, First Edition.

D. Reference Books:

1. Kibert J.Charles, "Sustainable Construction: Green Building Design and Delivery", Jhon Wiley & Sons Inc, 6th Edition, 2014.
2. Phillip F. Ostwald, "Construction Cost Analysis and Estimating", Prentice Hall Press, Delhi, 3rd Reprint, 2015.
3. Lal, Ashwini Kumar. Handbook of low-cost housing, New Age Publishers,4th Edition, 2010.

E. Course Outcomes:

1. Understand the values and societal importance of the built environment.
2. Understand the influence on a sustainable development.
3. Gain knowledge on how to use environmental impact assessments as a tool for design.
4. Construction and management of a sustainable built environment.

Subject Code: CE-320B
Subject Name: Design of RCC Structures – II
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the design concept of various structures and detailing of reinforcements.
2. To understand the design of underground and elevated liquid retaining structures.
3. To study the design of material storage structures.
4. To know the effect of temperature on concrete structures

B. Course Content:

1. Description of several RC structures – retaining wall, water tank, storage bins etc.
2. Detailed design of Cantilever and Counterfort type retaining walls.
3. Wind and Earthquake resistant design of buildings.
4. Design principles of underground and elevated water tanks.
5. Detailed design of rectangular and circular elevated water tanks as per IS 3370, Design of Ring Beam and staging for elevated water tanks: Intz Tanks etc.
6. Design of storage structures- silo and bunker

C. Text Books:

1. Krishnaraju, N., Advanced Reinforced Concrete Design, CBS Publishers, 2016.
2. Punmia, B. C., Jain, A. K., Jain, A. K., RCC Designs (Reinforced Concrete Design), Lakshmi Publishers, 2006.

D. Reference Books:

1. Varghese, P. C., Advanced Reinforced Concrete Design, PHI pub., 2005.
2. Bhavikatti, S. S., Advanced R.C.C Design, New Age International Pub., 2016.
3. Park, R., Paulay, T., Reinforced Cement Concrete Structures, Wiley India Pvt. Ltd, 2009.
4. Pillai U., Reinforced Concrete Design, McGraw Hill Pub, 2009

E. Course Outcomes:

1. Design of cantilever and counterfort retaining walls.
2. Design of underground and elevated water tanks.
3. Design of bunkers and silos.

Elective – V

Subject Code: CE 321A
Subject Name: Environmental Engineering -II
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Learn to analyze the efficiency of the wastewater treatment system
2. To design the sewer system in urban condition
3. Define and understand the municipal solid waste, its source, disposal and treatment methods
4. To learn about the air pollution and noise pollution.

B. Course Content:

Biological Unit Processes: Aerobic treatment; Suspended growth aerobic treatment processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters and Rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems; nitrification, denitrification; Phosphorus removal. Sludge Treatment: Thickening; Digestion; Dewatering; Sludge drying; Composting. Wastewater Treatment Plant Characteristics: Sequencing of unit operations and processes; Plant layout; Hydraulic considerations. Natural Wastewater Treatment Systems: Ponds and Lagoons; Wetlands and Root-zone systems. Solid waste management: Solid waste generation, onsite handling, storage and processing, collection, transfer and transport, processing techniques and equipment, recovery of resources, conversion products and energy, disposal. Hazardous waste management: Exposure and risk assessment, environment legislation, characterization and site assessment, waste minimization, incineration, transportation, storage, landfill disposal, facility sitting, site remediation. Biomedical waste management and handling: Biomedical waste management issues, waste generation, current practices in health care facilities, environmental concerns, labeling and colour coding for waste storage, collection, transportation, treatment, common treatment facility, disposal. Ecology and environment: Role of ecology in environmental issues, salient features of major ecosystems, energy transfer, local, regional and global impacts, ecological chain and balance, quantitative ecology in the context of environmental impact assessment of development project. Air pollution: Sources, emission of gases, suspended particulate matter, classification dynamics of pollutant dispersion and disposal, effects on environment including living and non-living matter, remedial measures and their effectiveness, environmental assessment, acts relating to air

pollution, standards. Noise pollution: Properties of sound waves, characterization of noise, kinetics of noise, rating systems, measurement and control standards.

C. Text Books:

1. Garg S.K., Water Supply Engg., Khanna Publications, 2003.
2. Masters G. M., Introduction to Environmental Engineering and Science, Prentice Hall, 2007.
3. Henry J. G., Heinke G. W., Environmental Science and Engineering, Prentice Hall, 1989.

D. Reference Books:

1. CPHEEO (Ministry of Urban Development), "Manual on Municipal Solid Waste Management".
2. Davis M.L., Cornwell D.A., Introduction to Environmental Engineering, McGraw- Hill Education, 2012**.**

E. Course Outcomes:

1. Analyze the wastewater treatment system efficiency and design various components.
2. Ability to know the control standards of air and noise pollution.
3. To understand the role of ecology in environment.
4. Select the method of treatment for different forms of MSW generated.

Subject Code: CE-321B
Subject Name: Environmental Systems Design and Modelling
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. The objective of the course is to provide basic knowledge on mathematical model construction and analyze environmental problems mathematically.

B. Course Content:

Introduction, Water Quality, Development of Mathematical Models, Reaction Kinetics, Mass Balance, Steady state solutions, Types of loadings, Types of Reactors, Incompletely mixed systems, Advection, Diffusion, Dispersion, Distributed systems (steady state and Time variable), Control Volume approach (Steady state solutions)

River Quality modelling, Streeter Phelps model, Fate and transport of pollutants in rivers and streams, Pulse and step inputs, transport in estuaries, Fate and transport of

pollutants in lakes, step and pulse input models, Fate and transport of pollutants in subsurface systems, Step and pulse input models.

Meteorological modelling: Comparison of boundary layer (BL) and free atmosphere characteristics, diurnal cycle of the ABL, convective BL, potential temperature, degree of turbulence, variance of the vertical and horizontal velocity, comparison between daytime and night time BL, prediction of CBL height and Monin-Obukhov length (L).

Air quality modelling (AQM): Major AQM types & scales, steps in model formulation, types of input required for dispersion modelling, Preparation of meteorological data for air quality models (surface and upper air data). Emission quantification for point, area and line sources. The box model, Gaussian plume and puff model, Receptor Models such as Chemical Mass Balance (CMB) and Positive Matrix Factorization (PMF). Performance evaluation of models: Model parameterization, calibration and validation, sensitivity analysis and its role, errors, and uncertainty analysis. Application of commonly used regulatory models (AERMOD, CALPUFF and CALRoads) and their applications to industrial problems.

C. Text Books:

1. Stull, R., Practical Meteorology: An algebra-based survey of atmospheric science, Univ. of British Columbia.
2. Chapra S.C., Surface Water-Quality Modelling, Waveland Pr Inc, 2008.

D. Reference Books:

1. Lazaridis M., First principles of meteorology and air pollution, Springer.
2. Paolo Z., Air pollution modelling, Springer, 2013.
3. Dunnivant F.M., Anders E., A Basic Introduction to Pollutant Fate and Transport , John Wiley & Sons.

E. Course Outcomes:

1. Describe the transport of water and air contaminants.
2. Description of naturally occurring process to released pollutants in mathematical form to develop models.
3. Use of regulatory models for the purpose of impact study and to device control management plan.

VII Semester						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-4101	Civil Engineering Construction and Development	3	0	0	3
2	CE-410A / CE-410B	Structural Analysis-II / Disaster Management	3	0	0	3
3	CE-411A / CE-411B	Estimation, Contract and Valuation / Design of Steel Structures - II	3	0	0	3
4	CE-412A / CE-412B / CE-412C	Irrigation and Hydraulic Structures / Ground Water Engineering / River Engineering	3	0	0	3
5	CE-410X	OE5*	3	0	0	3
6	CE-4102	Internship-II	0	0	0	1
7	CE-4103	Major Project-I	0	0	8	4
Contact Hours			15	0	8	
Total Credits						**20**

Subject Code: CE-4101
Subject Name: Civil Engineering Construction and Management
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To know the managerial duties and responsibilities.
2. To learn about man power planning and estimation of equipment cost.
3. To understand project planning and scheduling concepts.
4. To know the types of construction contracts and their drafting.
5. To learn the application of computer software in construction management .

B. Course Content:

Introduction – Project Planning, Scheduling, Controlling, Role of decision in project management, Techniques for analysing alternative: Operation research. Construction Project Formulation - Principles of Management – different types of construction projects –Project Life Cycle- phases in project life cycle- Pre-feasibility report and clearance- project estimate – Techno Economic feasibility report- detailed project report. Construction Planning and Scheduling – Work breakdown structure- plan development process- scheduling-definition –types of construction schedules-scheduling techniques-CPM – Terms and definitions –Earliest and Latest times – different types of floats – significance- calculation of critical path method-PERT – terms and definitions

network and solving problems using PERT – standard deviation and probability calculation in PERT. Resource Planning Allocation and Control – Materials - Quantity of materials – time of purchase- inventory control – terms and definitions – types of inventories –EOQ –reasons for maintain inventory – different tools for inventory. Equipment - Classification of major construction equipment- planning and selecting of equipment- task consideration – cost consideration. Labour - Classes of labour – cost of labour- labour schedule – optimum use of labour. Introduction- resource allocation-resource leveling-resource loading graph – cost control – earned value concepts- "S" curve technique in cost control – Risk cost management- stages in risk management-controlling the risk. Introduction to Estimation and costing - Importance, Items of a work and their units. Types of estimates, viz. preliminary; approximate; Abstract estimate; Plinth area estimate; detailed estimate; revised estimate; supplementary estimate, Bill of quantities and abstract of cost.

C. Text Books:

1. Jha, Kumar Neeraj., Construction project management: Theory and practice, Pearson Publication, 2015, Second edition.
2. Choudhary S, Project Management, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Dutta. B.N., Estimating and Costing in Civil Engineering: Theory and Practice including specifications and valuation, UBS Publishers and distributors, 27th revised edition.

D. Reference Books:

1. Chitkara, K. K. Construction project management. Tata McGraw-Hill Education Tata McGraw Hill Publishing Company Limited, New Delhi, 2019, Fourth Edition.
2. Puerifoy R.L, Construction Planning Equipment & methods, Tata McGraw-Hill Education Tata McGraw Hill Publishing Company Limited, 2010.

E. Course Outcomes:

1. To introduce a concepts of projects formulation.
2. To impart the idea about planning and scheduling of activities.
3. To introduce the concepts of resource planning and allocation and control.
4. To provide a bird's eye view of optimization techniques.

Subject Code: CE-410A
Subject Name: Structural Analysis – II
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To understand the influence line concepts for indeterminate structures.
2. To understand the methods of analysis of intermediate trusses for external loads, lack of fit and thermal effect.
3. To study behaviour of arches and their methods of analysis.
4. To know the concept and analysis of cable stayed bridge.
5. To study the multi storey frames subjected to gravity loads and lateral load.

B. Course Content:

1. **Introduction**- Statically determinate Vs Indeterminate structures, Flexibility method, Stiffness method, Degree of static indeterminacy, Degree of kinematic indeterminacy.
2. **Indeterminate beams** - Propped cantilever, Fixed and Continuous beams - Analysis for shear force and bending moment - Slope and deflection - effect of sinking of supports.
3. **Slope** - Deflection Method: Analysis and application to continuous beams - portal frames (single bay - Single storey).
   Moment-Distribution Method: Analysis of continuous beams and portal frames (single storey - single bay).
4. **Kani's method** - Application to continuous beams and portal frames, Approximate methods of analysis - Portal method - Cantilever method - Substitute frame method.
5. **Moving Loads** - Maximum bending moment and shear force diagrams for simply supported spans traversed by single point load - two concentrated loads - Uniformly distributed load, shorter and longer than the span - enveloping parabola and equivalent uniformly distributed load, determination of maximum bending moment and shear force for a system of concentrated loads on simply supported girders - focal length of a girder - counter bracing.
6. **Influence Lines** - Influence lines for reaction bending moment and shear force diagrams for simply supported beams - stresses in members of statically determinate pin jointed plane frames due to moving loads.
7. **Two Hinged Arches** - Determinations of horizontal thrust, bending moment, normal thrust and radial shear for parabolic and segmental shapes, Influence lines for two hinged arches - effect of rib shortening - temperature effects - tied arches.
8. **Suspension Bridges** - Force in loaded cable and hanging cables - length of cables for different support conditions - simple suspension bridges with three hinged and two hinged stiffening girders - bending moments and shear force diagrams, influence lines - temperature effects on cables and stiffening girders.

C. Text Books:

1. Jindal, R. L. *Indeterminate Structures*. S. Chand, & Co., New Delhi.
2. Reddy, C. S. *Basic structural analysis*. Tata McGraw-Hill Publishers, 2017.

D. Reference Books:

1. Wang, Chu-Kia. *Intermediate structural analysis*. McGraw-Hill Publishers, 2017.
2. Rajasekaran, S., & Sankarasubramanian, G. (2001). *COMPUTATIONAL STRUCTURAL MECHANICS: WITH CD ROM*. PHI Learning Pvt. Ltd.2003.
3. Gupta, S. P., Rajesh Gupta, and G. S. Pandit, *Theory of Structures (Vol. II)*, Tata McGraw Hill Pub., 2017.
4. Vazirani, V. N. Ratwani MM and Duggal SK, Analysis of Structures (Volume–II).", 1994.

E. Course Outcomes:

1. Use various classical methods for analysis of indeterminate structures.
2. Determine the effect of support settlements for indeterminate structures.
3. Apply the concepts of ILD and moving loads on determinate structures.
4. Apply the concept of equivalent UDL.
5. Analysis of two hinged arch and suspension bridge.

Subject Code: CE-410B
Subject Name: Disaster Management
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To know the types of Disasters and its triggering factures.
2. Understand the stages of disaster in hydrological disaster and kinds of data are required to support emergency management work during the disasters.
3. Develop and understand the causes, effects, impacts and analysis of hydrological, geological and coastal hazards.
4. Assess the potential of new, evolving technologies to meet vulnerability mapping, modelling and emergency management needs for geological hazards, hydrological and coastal hazards.

B. Course Content:

Introduction - Understanding Disaster, its relation with human development, Global and Indian scenario. Hazardous Waste Management - Definition and identification of hazardous wastes-sources and characteristics; hazardous wastes in Municipal Waste: Hazardous waste regulations, minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste-collection and transport, e-waste - sources, collection, and treatment and reuse management. Hazardous waste treatment. Design - Hazardous waste treatment technologies. 4. Landslide mitigation technology - Mechanics of landslide and prevention techniques, soil nailing, introduction of geo-synthetics etc.

5. Flood routing works - River training works and mechanics behind river erosion, flood control.

6. Effects of Earthquake and its control - Basic principles of earth quake resistant design of structures, Repair and retrofitting principles of earth quake damaged structures, concept of base isolation.

C. Text Books:

1. Punmia, B. C., Jain, A. K., & Jain, A. K., Soil mechanics and foundations. Firewall Media, 2005.
2. Punmia, B. C., "Environmental engineering (Vol-1)" LAXMI Publication New Delhi (2005).

D. Reference Books:

1. Agrawal, P., & Shrikhande, M., Earthquake resistant design of structures. PHI Learning Pvt. Ltd., 2006.

2. Fitts, C. R., Groundwater science. Elsevier. 2002.

E. Course Outcomes:

1. Understand the landslide mitigation technologies.
2. Better understanding of handling e-waste and hazardous solid waste.
3. Understand earthquake resistant structures.
4. Understand River training and flood control structures.

Subject Code: CE-411A
Subject Name: Estimation, Contract and Valuation
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To know the importance of preparing the types of estimates under different conditions.
2. To know about the rate analysis and bill preparations.
3. To study about the specification writing.
4. To understand the valuation of land and buildings.

B. Course Content:

Introduction - Importance, Items of a work and their units. Types of estimates, viz. preliminary; approximate; Abstract estimate; Plinth area estimate; detailed estimate; revised estimate; supplementary estimate, Bill of quantities and abstract of cost.
Preparation of detailed estimates - Preparation of specifications report accompanying the estimate. Approximate methods of Costing - types of estimates - costing for various structures. Rate analysis - Rate for material and labour - schedule of rates -data sheets - abstract estimate. Values and its kinds. Valuation - Purpose- scope - methods - land and building method - Factors affecting the value of plot and building - depreciation - Valuation of residential building with case study.Contracts- Introduction to Civil engineering contracts documents-PWD, CPWD etc. Preparation of Tender documents for Civil engineering works.

C. Text Books:

1. Dutta. B.N., Estimating and Costing in Civil Engineering: Theory and Practice including specifications and valuation, UBS Publishers and distributors, 27th revised edition.
2. Chakraborti. M, Estimating, Costing, Specification & Valuation in Civil Engineering, UBS Publishers and distributors, 2015.

D. Reference Books:

1. Birdie G.S., A Text Book of Estimating and Costing for Civil Engineering, Dhanpat Rai Publishing Company Private Limited, 2014.
2. Kohli D. D., Kohli R. C., A Textbook of Estimating and Costing (Civil), S Chand Publishing, 2013.
3. Bhasin, P.L., Quantity Surveying, 2nd Edition, S.Chand & Co., 2000. Department of Civil Engineering, National Institute of Technology: Tiruchirappalli.

E. Course Outcomes:

1. Apply different types of estimates in different situations.
2. Carry out analysis of rates and bill preparation at different locations.
3. Demonstrate the concepts of specification writing.
4. Carry out valuation of assets.
5. Understand the art of contract document and tender document preparation.

Subject Code: CE-411B
Subject Name: Design of Steel Structures - II
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To study the behaviour and design of member subjected to combined forces.
2. To understand the analysis procedure and design of base plate subjected to different loading conditions.
3. To study the design of Gantry girder, welded plate girder, stiffeners and connections.
4. To calculate the wind forces on various types of structures.
5. To understand the design of industrial buildings/bents.
6. To understand the design of moment resisting connections used in steel frames.

B. Course Content:

Introduction to beam-column - Behaviour - strength interaction - design of beam column - beam - column subjected to combined forces - column bases - slab base - gusseted base - moment resistant base plate. Welded plate girders – Analysis and design using IS800-2007 - curtailment of flange plates –stiffeners – Introduction to hybrid girders - analysis and design of gantry girder. Design of industrial building - Roofing, cladding and wall material - structural components and framing - types of roof trusses - components - wind load estimation for different type of structures for various zones. Approximate analysis of industrial bents/PEB - Design of purlins and wall girts using Channel and Angle

sections; cold formed steel purlin – Design of wind bracings – wind girders – gable columns. Analysis and design of framed connections.

C. Text Books:

1. Duggal S.K., Limit State Design of Steel Structures, Tata Mc Graw Hill Publishers, 2019, 3rd Edition.
2. IS 800 - 2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.

D. Reference Books:

1. Bhavikatti, S.S., Design of Steel Structures, I.K. International Publishing House Pvt. Ltd., New Delhi, 2010.
2. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi 2008.
3. IS 875 Part (3) - 1987, Code of Practice for Design Loads (other than earthquake) for buildings and structures: Wind loads. Bureau of Indian Standards, New Delhi.
4. SP6 (1) - 1964, IS hand book for structural Engineers. Bureau of Indian Standards, New Delhi.

E. Course Outcomes:

1. Design of eccentrically loaded compression members (Beam-Columns) and their base plates.
2. Design of welded plate girder and other components.
3. Design of Gantry girder for industrial structures.
4. Calculation of the wind load acting on various structures to be built in various locations.
5. Design of Industrial structures and their components such as girts, wind girders, bracings systems purlins etc.

Subject Code: CE – 412A
Subject Name: Irrigation and Hydraulic Structures
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the water requirement for crops
2. To study various methods of irrigation
3. To understand the requirements and types of cross drainage works
4. To design various types of canal falls.

B. Course Content:

Water requirement of crops: Crop period or base period, delta of a crop, delta on a field, relation between duty and delta, food and non-food crops, kharif and rabi crops, gross command area, cultivable command area, intensity of irrigation, net and gross sown areas

Irrigation Methods: Types of irrigation, methods of applying water to the crops, surface, subsurface irrigation, sprinkler irrigation, uncontrolled or wild floods, free flooding, Furrow irrigation, water logging, salinity

Canals: classification, most economical sections, Design of non-scouring channels, channel or channel losses, advantages of lining, Design of stable channels, Silt theories

Surface and subsurface flow analysis in hydraulic structures: Hydraulic structures on permeable foundation, Seepage theories, Principles of design of hydraulic structures on permeable foundation

Cross drainage works: Introduction, Types of cross drainage works-Aqueduct, siphon aqueduct, super passage, canal-syphon or siphon, level crossing, inlets and outlets, selection of cross-drainage works

Canal falls: Location of falls, types of falls, classification of falls, Design of straight glacis fall, design of sarda type fall

Canal regulations and outlets: Canal escape types of canal escapes, canal regulator, distributor head regulator, Types of outlets, performance of modules, types of non-modular outlets-open sluice and submerged pipe outlet, rigid modules

Gravity Dams: Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam

River training works: Introduction, different methods

Spillway: Introduction, types, design of spill way, energy dissipation structures.

C. Text Books:

1. Murthy, C. S. N., Water Resources Engineering – Principles and Practice, New Age International Publishing Company, New Delhi, 2020
2. Garg S K, Irrigation Engineering & Hydraulic Structures, Khanna Publishers, Delhi,1999
3. Arora, K. R., Irrigation, Water Power & Water Resource Engineering, Standard Book Publishing Company, New Delhi, 2010.

D. Reference Books:

1. Asawa, G. L., Irrigation and Water Resources Engineering, New Age International Publishing Company, New Delhi, 2005
2. Modi, P. M., Irrigation Water Resources and Hydropower Engineering, Standard Book Publishing Company, New Delhi. 2008.

E. Course Outcomes:

1. Classify various irrigation methods
2. Design irrigation canals and diversion headwork
3. Understand the requirements of cross drainage works
4. Design canal falls and spillway

Subject Code: CE – 412B
Subject Name: Ground Water Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To provide knowledge on properties of water bearing strata
2. To analyse the groundwater flow and well dynamics
3. To develop ground water flow model
4. To analyse the ground water quality

B. Course Content:

Hydrogeological Parameters: Introduction – Water bearing properties of rock – Type of aquifers, Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation, Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms

Well Hydraulics: Objectives of Groundwater hydraulics – Darcy's Law – Groundwater equation, steady state flow - Dupuit Forchheimer assumption, Unsteady state flow - Theis method - Jacob method -Slug tests - Image well theory – Partial penetrations of wells.

Groundwater Management: Need for Management Model – Database for groundwater management –groundwater balance study, Introduction to Mathematical model – Conjunctive use, Collector well and Infiltration gallery, Artificial recharge techniques

Groundwater Quality and Conservation: Ground water chemistry - Origin, movement and quality - Water quality standards – Health and aesthetic aspects of water quality, Contamination source inventory, remediation schemes - Ground water Pollution and legislation, Saline intrusion – Environmental concern and Regulatory requirements, Remediation of Saline intrusion.

C. Text Books:

1. Todd D.K, Ground Water Hydrology, John Wiley and Sons, 2011.
2. William C Walton, Principles of groundwater engineering, CRC Press, 2020.

3. Raghunath H.M, Ground Water Hydrology, New Age International (P) Limited, 2007.

D. Reference Books:

1. Fitts R Charles, Groundwater Science, Elsevier, Academic Press, 2012.
2. Kumar, P. Groundwater and well drilling: A reference book on groundwater and wells, CBS, 2018.

E. Course Outcomes:

1. Understand the properties of aquifer
2. Solve well hydraulics problems
3. Develop and solve mathematical flow models
4. Understand the groundwater quality issues

Subject Code: CE – 412C
Subject Name: River Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand the flow process in rivers
2. To analyse the sediment and energy transport process in rivers in spatial and temporal scales
3. To develop model for hydro-fluvial process
4. To design river intervention structures.

B. Course Content:

Physical Properties and Equations: Dimensions and units, Properties of water and sediment, River flow kinematics, Conservation of mass, Equations of motion, Hydraulic and energy grade lines. Steady Flow In Rivers: Steady river flow, Steady-nonuniform river flow, Sediment transport in rivers. Unsteady Flow In Rivers: River continuity equation, River momentum equations, River flood waves, Loop-rating curves, River flood routing, River flow and sediment-duration curves. River Equilibrium: Particle stability, Channel stability, Regime relationships, Equilibrium in river bends, Downsteam hydraulic geometry, Bars in alluvial rivers, River meandering, Lateral river migration. River Dynamics: River dynamics, Riverbed degradation, Riverbed aggradation, River confluences and branches, River databases. River Stabilization and River Training Work: Riverbank stability, Riverbank riprap revetment, Riverbank protection, River flow-control structures, River training along braided rivers. River

Engineering: River flood control, River closure, Canal headworks, Bridge scour, Navigation waterways. River Modelling: Rigid-bed model, Mobile-bed river models, Finite-difference approximations, One-dimensional river models, Multidimensional river models. Sediment transport: Sediment properties, Loop Rating curve, sediment transport in river.

C. Text Books:

1. Garde R J, River Morphology, New Age International Ltd,2015
2. Julien Pierre Y., River Mechanics, Cambridge University Press, 2002.

D. Reference Books:

1. Margaret S Peterson, River Engineering, Prentice Hall,1986
2. Journal of Hydrology (Elservier), Sediment Research, ASCE Journal of Hydraulic Engineering.

E. Course Outcomes:

1. Understand the physical properties and flow process in rivers.
2. Analyse the sediment and energy transport process in rivers.
3. Develop model for hydro-fluvial process.
4. Design river intervention structures.

VIII Semester						
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CE-421A / CE-421B/ CE-421C	Environmental Impact Assessment / Solid and Hazardous Waste Management / SWAYAM Course	3	0	0	3
2	CE-422A / CE-422B / CE-422C/ CE-422D	Pre-stressed Concrete Structures / Earthquake Resistant Structures / Advanced Foundation Engineering / SWAYAM Course	3	0	0	3
3	CE-4201	Major Project-II	0	0	22	11
Contact Hours			6	0	22	
Total Credits						**17**

Subject Code: CE-421A
Subject Name: Environmental Impact Assessment
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Define and Classify Environmental Impacts and the terminology.
2. Understands the environmental Impact assessment procedure.
3. Explain the EIA methodology and management.
4. List and describe environmental audits.
5. Assessment of Socio-Economic Impacts.

B. Course Content:

Introduction to Environment: Definition, Atmosphere, Hydrosphere, Lithosphere, Biosphere scope, components, structure, and composition. Environmental quality, monitoring, and base line data.

Introduction to EIA: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance Application form, Composition of Expert Committee, Ecological sensitive places, international agreements

Environment Management: Natural Resources Conservation, Conservation of Energy, Pollution prevention, Disposal of Treated effluents, Environmental Audit, Concept of green cities.

EIA Methodologies: Environmental Attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods Overlays methods. EIA review- Baseline Conditions - Construction Stage Impacts, post project impacts.

Environmental management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

Environmental legislation and life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wildlife act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria- case studies

Case studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Airports.

C. Text Books:

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002.

D. Reference Books:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996

E. Course Outcomes:

1. Identify the environmental attributes to be considered for the EIA study.
2. Formulate objectives of the EIA studies.
3. Identify the methodology to prepare rapid EIA.
4. Prepare EIA reports and environmental management plans.

Subject Code: CE-421B
Subject Name: Solid and Hazardous Waste Management
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To provide in depth understanding of Hazardous and Waste characteristics and management.
2. The course covers the planning and engineering principles needed to address the Hazardous and Biomedical Waste Management.
3. Study the latest trend of disposal and recovery methods and transportation of the waste.

B. Course Content:

Introduction: Solid waste: Evolution, source types and generation of solid waste: introduction to solid waste, functional elements, types and source of solid waste, sampling and characteristics, estimations of solid waste, factors affecting solid waste generation rate.

Waste handling, storage, processing and types of collection of solid waste: handling, separation and storage at source, processing at the source, primary collection, types of primary collection, Analysis of solid waste collection system and types of transfer system: analysis of collection system (part I, II, III) , need and types of transfer station.

Solid waste transport means, methods, separation, and processing: transport means and methods, unit operation for component separation, material recovery facilities (MRF), recycling of dry waste components, Disposal, and recovery methods: incineration, composting, anaerobic digestion, landfill, especial waste and integrated solid waste management, finance and PPP related to solid waste management.

Policies related to solid waste like MSW, C&D, Plastic waste, Bio-medical waste, E-waste, Collection and handling of above-mentioned waste types may also be included in the syllabus, Treatment Technologies such as pyrolysis, gasification, bio-CNG, Biofuel production may also include.

Hazardous Wastes: Definition, Sources and Classification; Characteristics of Hazardous wastes: Ignitability, Corrosivity, Reactivity, Toxicity, Generation of Hazardous Waste, Guidelines of Hazardous Waste Management, Basel Convention, Regulatory framework: Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; Monitoring of critical parameters/risk-analysis. HAZAN, HAZOP; Environmental Impacts of Hazardous Wastes; Emergency Management: Indian and foreign legislation in respect of the above. Storage, Collection and Transport of Hazardous Waste; Processing and Disposal of Hazardous Wastes; Treatment, Storage and Disposal Facility; Hazardous Waste Reduction; Hazardous Waste Treatment, Physical and Chemical Treatment,

Thermal Treatment, Incineration, Combustion Calculation and Air requirements, Environmental Control Measures, Pyrolysis, Biological Treatment, Hazardous Waste Landfills, Secure Landfill, Site Selection, Component of Landfill, Landfill Design and Operation, Deep Well Injection.

Hazardous Chemicals: Toxic chemicals, Flammable Chemicals, Pesticides, Explosives, Reactive Substances, Cyanide Wastes, Water-soluble Chemical Compounds of Heavy Metals, & Toxic Metals; Hydrocarbons, Point Pigment Dyes, Oil Emulsion Tars, Phenols, Asbestos, Acid/Alkaline Slurry, Physical Properties, Chemical Composition; Lethal Dose and Concentration on Human Life, Flora and Fauna; Case studies, Leakages, Explosion, Oil-spills, Fire of Hazardous Chemical Storage.

C. Text Books:

1. Frank Kreith and George Tchobanoglous Handbook of Solid Waste Management Book, Mc Graw Hill handbook.
2. George Tchobanoglous; Integrated solid waste management; Mc Graw Hill handbook, 28 april 2014.
3. S.K. Garg „Water Supply Engg. (Vol. I)" Khanna Publications, 2003.
4. Sunil Kumar, Municipal Solid Waste Management in Developing countries, Handbook CRC Press Taylor & Francis, 2016.

D. Reference Books:

1. Vasudevan Rajaram, Mohammed Emran Khan, Sanjeev Agrawal, Faisal Zia Siddiqui Solid and Liquid Waste Management: Waste to Wealth Edition1st First Published 2016.
2. Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016.
3. Solid Waste Management Rules, 2016.

E. Course Outcomes:

1. The students will be aware of the waste generation and disposal system.
2. A comprehensive overview of hazardous and biomedical wastes management from both scientific and engineering principles point of view.
3. Understanding of the fundamental principles of existing and emerging technologies for the treatment of hazardous and biomedical wastes.
4. Understanding of the legislative and regulatory framework related to the generation, treatment, storage.

Subject Code: CE-422A
Subject Name: Pre-stressed Concrete Structures
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To learn the principles, materials, methods and systems of prestressing.
2. To know the different types of losses and deflection of prestressed members.
3. To learn the design of prestressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam.
4. To learn the design of anchorage zones, composite beams, analysis and design of continuous beam.
5. To learn the design of water tanks.

B. Course Content:

Fundamentals of prestressing - Classification and types of prestressing Concrete Strength and strain characteristics - Steel mechanical properties - Auxiliary Materials like duct formers.

Prestressing Systems: Principles of pre-tensioning and post tensioning - study of common systems of prestressing for wires strands and bars.

Losses of Prestress: Losses of prestress in pre tensioned and post tensioned members - I.S. code provisions.

Analysis of Sections: In flexure, simple sections in flexure, kern distance - cable profile - limiting zones - composite sections cracking moment of rectangular sections.

Design of Simply Supported Beams: Allowable stress as per I.S. 1343 - elastic design of rectangular and I-sections.

Shear and Bond: Shear and bond is prestressed concrete beams - conventional design of shear reinforcement - Ultimate shear strength of a section - Prestress transfer in pretensioned beams-Principles of end block design.

C. Text Books:

1. Krishna Raju. N., “Prestressed Concrete”, Tata Mc Graw Hill.,6th Edition.
2. Lin.T.Y, “Prestressed concrete”, Wiley India, 2010.

D. Reference Books:

1. Nawy, E. G., Prestressed concrete a fundamental approach 4th edition, Pearson Education, Inc. New Jersery, US., 2003.
2. IS 1343:2012. Prestressed concrete - code of practice, Bureau of Indian Standards (BIS), New Delhi, India., 2012.

3. Rajagopalan, “Prestressed concrete”, Narosa Publishing House, 2017, 2nd Edition.

E. Course Outcomes:

1. Understand the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing.
2. Analyse a Pre-stressed Concrete section.
3. Estimate losses of pre-stressing.
4. Design pre-tensioned and post tensioned girders for flexure and shear.
5. Design continuous pre-tensioned and post tensioned beams.

Subject Code: CE-422B
Subject Name: Earthquake Resistant Structures
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To introduce the basics of Earthquake Engineering.
2. To introduce the engineering seismology, building geometrics & characteristics, structural irregularities.
3. To introduce tips on earthquake engineering – do’s and don’ts.
4. To introduce cyclic loading behaviour of RC, steel, and pre-stressed concrete elements.
5. To discuss code provisions and their application on different types of structures.

B. Course Content:

Reid’s theory, Theory of plate tectonics, Seismic waves, Earthquake size, Local site effects, Internal structure of earth, seismotectonic of India, Seismicity of India, Classification of earthquakes.

Elements of Earthquake Engineering: Earthquake magnitude and intensity, Focus and Epicentre, Causes and Effects of Earthquakes, Characteristics of Earthquake, Seismic zone mapping.

Structural Systems for Seismic Resistance: Structural systems – building configuration, frames, walls, dual systems – response in elevation – plan – influence of structural classification- Concepts of seismic design.

Analysis for Earthquake Loads: IS: 1893-2002- Seismic Coefficient method- modal analysis- Applications to multi-storied building frames – water tanks – chimneys.

Ductile Detailing: Ductility of R.C structures- Confinement- detailing as per IS-13920-1993- moment redistribution – principles of design of beams, columns – beam column joints – soft story concept.

Base Isolation: Isolation systems – Effectiveness of base isolation.

C. Text Books:

1. Duggal S.K., Earthquake resistant design of structures, Oxford, 2nd Edition, 2013
2. Chopra A.K., Dynamics of structures, Prentice Hall.
3. Bureau of Indian Standards, I.S 1893 - 2002, Criteria for Earthquake Resistance design of Structures.

D. Reference Books:

1. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.
2. Agrawal, P., & Shrikhande, M., Earthquake resistant design of structures. PHI Learning Pvt. Ltd., 2006.

E. Course Outcomes:

1. Apply seismic coefficient and response spectrum methods for analysis of multi storied buildings.
2. Apply concepts of ductility in the design of multi-storeyed structures.
3. Analyse a water tank structure based on latest earthquake code.
4. Understand the concepts of base isolation.

Subject Code: CE-422C
Subject Name: Advanced Foundation Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To impart the knowledge of the sub surface investigation and bore log report interpretation.
2. To develop the knowledge and skills for evaluating the bearing capacity of the soil.
3. To analyze and evaluate the load carrying capacity of the various types of foundation

B. Course Content:

Introduction, planning of soil exploration for different projects, methods of borings along with various penetration tests, geophysical soil exploration. Shallow foundations, methods of estimating bearing capacity of combined footings and rafts, foundations under eccentric loading. Foundations under inclined loading, foundations on slope, foundations with tilted base. Bearing capacity of foundations on layered soil. Advanced methods of estimating

settlement of footings and rafts, concept of Beams on Elastic Foundation. Concept of Beams on Elastic Foundation (continued). Proportioning of foundations using field test data, IS codes. Pile foundations, pile load tests, methods of estimating load transfer of piles, analytical estimation of load-settlement behaviour of piles. Advanced analysis for pile group capacity and settlement, negative skin friction of piles. Laterally loaded piles. Uplift capacity of piles, foundations/anchors under uplift loads, well foundation, bearing capacity of well foundations, lateral stability of well foundations. IS and IRC codal provisions, elastic theory and ultimate resistance methods for well foundations, foundations on problematic soils: foundations for collapsible and expansive soil. Drilled pier foundation, An introduction to soil-structure interaction, An introduction to soil improvement.

C. Text Books:

1. Braja M. Das, "Principles of Foundation Engineering." PWS Publishing, USA. 1999.
2. Bowles, J.E., Foundation Analysis and Design", Fifth ed. McGraw-Hill, Singapore. 1997.
3. Ranjan, G. and Rao, A. S. R., Basics and Applied Soil Mechanics", New Age International. 2007.

D. Reference Books:

1. Murthy, V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering', Marcel Dekker, Inc. New York. 2001.

E. Course Outcomes:

1. Describe the requirements for the successful design of foundation elements.
2. Evaluate factors affecting the planning of subsurface investigations.
3. Analyze the results of in-situ tests and transform measurements and associated uncertainties into relevant design parameters.
4. Analyze the bearing capacity of shallow foundations.
5. Evaluate immediate settlement of shallow foundations.
6. Analyze single and groups of piles and drilled shafts for axial capacity.
7. Analyze single and groups of piles and drilled shafts for lateral capacity.

OPEN ELECTIVES

(Offered by CE Dept. for other Departmental Students)

Sl No	Course Code	Course Title	L	T	P	C
1	CE-210X	OE1 - Environmental Science and Engineering	3	0	0	3
2	CE-220X	OE2 - Soil Mechanics and Foundation Engineering	3	0	0	3
3	CE-310X	OE3 - Structural System and Analysis	3	0	0	3
4	CE-320X	OE4 - Water Resources Engineering	3	0	0	3
5	CE-410X	OE5 - Transportation Engineering	3	0	0	3
Contact Hours			15	0	0	
Total Credits						**15**

Subject Code: CE-210X
Subject Name: Environmental Science and Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To develop understanding of atmospheric science including quantifying climate sensitivity to changes in greenhouse gases and interrelation between the various components of the climate system.
2. To define and classify natural water sources, water demand, population forecasting
3. To study the various water treatment methods for drinking and waste water
4. To understand and study the urban - rural sanitation system

B. Course Content:

Introduction: Environment and ecology, source of water, water demand and supply, population forecasting, design period. Physical chemical and biological characteristics of water and waste water, chemical significance of pollutant parameters and effluent discharge standards.

Treatment objective and methods: Primary treatment: screening, neutralization, equalization, flocculation, sedimentation, floatation, stripping. Tertiary treatment: Oxidation/reduction, precipitation, adsorption, ion exchange and membrane processes, disinfection.

Water distribution systems: different pipe systems, design considerations, laying, testing and effects of pipe corrosion and its preventive measures. Sewers: hydraulic design, construction and appurtenances, operation and maintenance. Pumps and pumping: necessity, types of pumps, characteristics curves, selection criteria, economical diameter of pumping/transmission main, problems in sewage pumping.

Distribution network: methods, layout, storage, and distribution reservoir, analysis of distribution systems. **Plumbing systems:** General principles, materials for service pipe, service connection, water meters, and valves, Principles of house drainage, pipes, traps, sanitary fittings, systems of plumbing, house drainage plans.

Rural and Semi urban sanitation: Collection and disposal of dry refuse, sullage, excretal waste, night soil disposal without water carriage, latrines, chemical toilets, precast units for low cost sanitation. Management of municipal solid waste (MSW), source, method of collection, disposal, landfill types.

Air pollution: Fundamentals of air pollutants and impact, ambient air monitoring, emission factors; overview of prediction models, air pollution control techniques, suppression and consolidation of dust.

Noise Pollution: Fundamentals of Noise Pollution and Impact, monitoring and control measures.

C. Text Books :

1. Punmia B.C., Environmental Engg. (Vol. I), Laxmi Publications, 2005.
2. Garg S.K., Water Supply Engg. (Vol. I), Khanna Publications, 2003.

D. Reference Books:

1. Peavy & Rowe, Environmental Engineering, McGraw Hill Publications, 2017.
2. Birdie G.S., Water Supply, Dhanpath Roy publication, 2017.
3. Davis M. L., Cornwell A. A., Introduction to environmental engineering, Mc Graw Hill publishers, 2014.

E. Course Outcomes:

1. Students will understand source and cycle of water in our environment,
2. Will be able to calculate the water demand in a city and select a mode of water supply
3. Students will be able to design the various water and waste treatment components
4. Students will be able to deal with the various rural and urban sanitation systems

Subject Code: CE-220X
Subject Name: Soil Mechanics and Foundation Engineering
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. Understand the concept of Geotechnical Engineering.
2. To have idea of the different properties of soil
3. To have the concept of site investigation and subsurface exploration.
4. To be able to understand the bearing capacity of the soil

5. To have knowledge of the various tests that can lead to the assessment of the bearing capacity of soil.
6. Students will be able to calculate the settlement of foundations

B. Course Content:

Origin, Classification, and Index Properties: Identification and classification of soils, Index properties, phase relationship, consistency, sensitivity, clay mineralogy.

Seepage: Darcy's law of permeability, Determination of Coefficient of permeability, Equivalent permeability for stratified soil, Flow nets – principles, construction and application, Effective stress analysis, quick sand condition, piping, filtration criteria.

Compaction: Principle of compaction, Light and heavy compaction, field compaction control, factors affecting compaction, effect of compaction on soil properties. Compaction of cohesionless soil, relative density

Compressibility and Consolidation: Terzaghi's theory of one-dimensional consolidation, Secondary Consolidation, Assessment of various consolidation parameters, estimation of consolidation settlement.

Shear Strength of Soil: Strength envelope, total and effective stress paths, pore pressure, evaluation of shear strength parameters, direct shear, triaxial shear, vane shear, unconfined compression test.

Subsurface Investigation: Purpose of site investigation, Borings method, Auger Boring, Wash boring, Percussion boring, Area ratio, Soil report, Soil profiling.

Shallow and Deep Foundations: Factors effecting locations of foundation and design considerations of shallow foundations, Choice of type of foundations, Foundations on expansive soils, Introduction to pile foundation and classification of piles.

Bearing Capacity: Safe bearing capacity, allowable bearing pressure, Terzaghi's bearing capacity equation and its modifications for square, rectangular and circular foundation, General and local shear failure conditions, Factors affecting bearing capacity of Soil, Allowable bearing pressure based on values, bearing capacity from plate load tests, ultimate bearing capacity of piles, pile load test, group carrying capacity of pile.

C. Text Books:

1. Ranjan G., Rao A S R., Basic and applied soil Mechanics, New age international Punlishers, 2016.
2. Punmia B.C., Jain K A., Soil Mechanics and foundations, Khanna Publishers, 2021.

D. Reference Books:

1. Arora K.R., Soil Mechanics and Foundation Engineering, PHI publishers, 2016.

2. Das M. B., Fundamentals of Geotechnical Engineering, Cengage learning, 2010.

E. Course Outcomes:

1. Students would be aware of the basic understanding of geotechnical engineering and various classification and properties of soils.
2. Students will be knowledgeable in bearing capacity calculation.
3. Student will know the method to solve the settlement problems in foundations.
3. Ability to do site investigations and subsurface explorations.

Subject Code: CE-310X
Subject Name: Structural System and Analysis
Credit Point: 3 (L=3, T=0, P=0)

A. Course Objectives:

1. To understand the importance of degrees of freedom and the concept of principle of superposition.
2. To know about the concept of strain energy and principle of virtual work.
3. To study the transformation of system matrices and element matrices for the determinate and indeterminate structures.
4. To analyse the forces in structures like continuous beam, truss and frames using stiffness and flexibility method.
5. To understand the behaviour of structures due to thermal expansion and lack of fit.

B. Course Content:

Degrees of freedom - Constrained Measurements - Behaviour of structures - Principle of superposition. Stiffness and flexibility matrices - Constrained measurements - Stiffness and flexibility coefficients from virtual work.

Strain energy - Stiffness and flexibility matrices from strain energy - Symmetry and other properties of stiffness and flexibility matrices - Betti's law and its applications - Strain energy in systems and in elements.

Determinate and indeterminate structures - Transformation of element matrices to system matrices - Transformation of system vectors to element vectors - Normal coordinates and orthogonal transformations. Flexibility method applied to statically determinate and indeterminate structures - Choice of redundant - Transformation of redundant - Internal forces due to thermal expansion and lack of fit. Development of the method - Internal forces due to thermal expansion and lack of fit - Application to symmetrical structures - Comparison between stiffness and flexibility methods

C. Text Books:

1. Rubenstein M.F., Matrix Computer Analysis of Structures, Prentice Hall, 1986.
2. Jindal, R.L., Indeterminate Structures, S.Chand & Co., New Delhi, 1980.
3. Rajput R. K., Strength of Materials: Mechanics of Solids, S. Chand Limited, 2006.
4. Negi L. S., Theory and Problems in Structural Analysis, Tata McGraw Hill Pub., 1997.

D. Reference Books:

1. Rajasekaran S, Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2001.
2. Bhavikatti, S. S., Engineering Mechanics, New Age International Private Limited, 2021.
3. Charles H.R., Tan K.H., Structural analysis, Pearson, 2017.
4. Manickaselvam V.K., Elements of Matrix and Stability Analysis of Structures, Khanna Publishers, New Delhi, 1998.

E. Course Outcomes:

1. Apply the basic concepts of matrix methods in structural analysis.
2. Develop stiffness and flexibility matrices.
3. Analyse the structures using flexibility and stiffness method.
4. Transform system coordinates to element coordinates.
5. Determine the forces in various members due to lack of fit and thermal expansion

Subject Code: CE – 320X
Subject Name: Water Resources Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. To understand basic fluid properties.
2. To provide knowledge on various components in hydraulic cycle.
3. To analyse a hydrograph.

B. Course Content:

Properties of fluids: viscosity, compressibility, ideal and real fluids, Newtonian and non-Newtonian fluids, surface tension, piezometers and manometers.
Introduction to Hydrologic cycle: water budget equation, basic concepts of weather systems, characteristics of precipitation in India.
Precipitation: Weather system for precipitation, Characteristics of precipitation, Rain Gauge Network, Test for consistency of data, analysis of rainfall data.

Evaporation: measurement, estimation and control of evaporation, Evapotranspiration, measurement and estimation of evapotranspiration, interception and depression storage, Infiltration process, measurement of infiltration.
Runoff: Runoff characteristics of streams, runoff computation.
Hydrograph: Factors affecting flood hydrograph, components of a hydrograph, base Flow separation, effective rainfall, unit hydrograph, derivation of unit hydrograph, unit hydrograph of different durations, use and limitations of different hydrograph.

C. Text Books:

1. Cimbala J.M., Cengel Y. A., Fluid Mechanics: Fundamentals and Applications, McGraw-Hill Publication, 2020.
2. Subramanya, K., Engineering Hydrology, Tata Mc Graw Hill Pub. Co., New Delhi, 2017.

D. Reference Books:

1. Chow, V. T., Maidment, Mays, L. A., Applied Hydrology, Tata Mc Graw Hill Pub. Co., New York, 2017.

E. Course Outcomes:

1. Understand the fluid properties.
2. Analyse the various aspects of components in hydrologic cycle.
3. Have knowledge on hydrograph and unit hydrograph.

Subject Code: CE-410X
Subject Name: Transportation Engineering
Credit Point: 3 **(**L=3, T=0, P=0)

A. Course Objectives:

1. Provide a systematic understanding of the causes and motivations of Highway location, planning and geometric design.
2. To have idea about road planning and development.
3. To have idea about the pavement design.
4. To have idea about the hill roads and highway maintenance.

B. Course Content:

Road development and planning: Brief history of road development, Road cross section, necessity of transportation planning, classification of roads, road patterns,

planning surveys, saturation system, highway planning in India, road development plans.

Highway location and alignment: Basic requirements of an ideal alignment and factors controlling, engineering survey for highway location, drawing and reports, highway projects.

Highway geometric design: Highway cross section elements, sight distances, Design of horizontal alignment, Transition curves and vertical alignment.

Pavements design: Design factors, Design of flexible pavements, CBR, GI and Bur mister methods, Design of rigid pavements.

Pavement materials: Soils, Aggregates and their characteristics, bituminous materials and mixtures, Portland cement concrete.

Hill roads: General considerations, alignment, geometric design and construction, drainage, and maintenance problems in hill roads.**Highway maintenance**: Pavement failures, maintenance of highway pavement, evaluation and strengthening of existing pavements.

C. Text Books:

1. Khanna K S., Justo C E G., Veeragavan A., Highway Engineering, Nem Chand & Bros, 2020
2. Kadiyali R. L., Transportation Engineering, Khanna Publishers, 2021
3. Venkatramiah C., Transportation Engineering (Highway Engineering), Orient Blackswan private limited, 2015.

D. Reference Books:

1. Papacostas S C., Prevedouros D P., Transportation Engineering, PHI publishers,2016
2. Chakroborty P., Principles of Transportation Engineering, PHI publishers,2020.

E. Course Outcomes:

1. Students will idea about the history of road development and planning in India.
2. Students will be confident in flexible and rigid pavement designing.
3. Students will have idea about the construction of highways.
4. Students will be able to do planning and development of hill road.