BACHELOR OF TECHNOLOGY (B.Tech.)

CIVIL ENGINEERING

SYLLABUS

Effective From
2023-24

DEPARTMENT OF CIVIL ENGINEERING
Faculty of Engineering & Technology
Jamia Millia Islamia
Maulana Mohammad Jauhar Ali Marg
Jamia Nagar, New Delhi-110025

https://www.jmi.ac.in/civil

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FOREWORD

To keep pace with the modern technologies and changing job market scenario, the revision and modification of the syllabus becomes crucial. This version of syllabus for the Bachelor of Technology (B. Tech.) in Civil Engineering, has been developed in alignment with the National Education Policy (NEP) 2020 and AICTE Model Curriculum. The restructured curriculum reflects our unwavering commitment to providing an education that is both contemporary and comprehensive, preparing students to meet the ever-evolving demands of the Civil Engineering profession and equipping them with the skills needed to thrive in a dynamic global landscape.

A key feature of this updated syllabus is the introduction of Honours and Minor. The Honours offers students the opportunity to pursue specialized knowledge in a wide range of emerging areas within Civil Engineering such as Structural Engineering, Environmental Engineering, Water Resources Engineering etc. The minor encourages interdisciplinary learning, enabling students to explore subjects outside the traditional Civil Engineering scope such as Data Science, AI&ML, Electric Vehicles and Automation & Robotics which are increasingly influencing the future of infrastructure development. By fostering these interdisciplinary skills, our graduates can engage effectively with the evolving demands of the industry, which requires strong technical expertise along with a broad understanding of related domains.

In addition to academic excellence, this updated syllabus emphasizes the cultivation of ethical values, understanding of Indian Knowledge System, incorporation of SDGs, and social responsibility—core tenets of NEP 2020.

We are confident that this updated syllabus will not only prepare our students to excel in their chosen careers but also inspire them to become leaders in the field of Civil Engineering—professionals who are equipped with the technical skills, ethical grounding, and interdisciplinary mindset necessary to build sustainable, resilient, and smart infrastructure for the future.

I wish to acknowledge the hard work put in by the faculty members and all stakeholders in updating and revision of syllabus. I also wish to convey my sincere thanks to the subject experts who gave their valuable inputs in finalizing this syllabus.

I wish all our students the best as they embark on this exciting academic journey and encourage them to take full advantage of the new opportunities this updated curriculum offers.

(Prof. Farhan Ahmad Kidwai)
HoD, Civil Engineering

TABLE OF CONTENTS

(B. Tech.) Civil Engineering - Syllabus

TABLE OF CONTENTS

TABLE OF CONTENTS

VISION OF THE DEPARTMENT

To emerge as center of excellence for education and research in civil engineering and to produce professionally competent and ethically sound engineers of global standards, ready to serve the community and the nation with dedication.

MISSION OF THE DEPARTMENT

1. To provide rigorous hands-on civil engineering education through learner centric teaching pedagogy.
2. Establish state-of-the art facilities for teaching and research in civil engineering domain.
3. Motivate students to develop low-cost and sustainable ethical solutions to problems faced by the society.
4. Provide opportunities to students to enable them to develop leadership and interpersonal skills.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

1. The graduates shall demonstrate the ability to use professional skills including software tools and computational methodologies for the analysis, design, and management of infrastructure projects.
2. The graduates shall practice high ethical values and effective communication skills so as to participate as a member of a multidisciplinary team working on various projects.
3. The graduates shall continue lifelong learning and take up leadership roles in professional and entrepreneurial settings.

PROGRAM OUTCOMES (POs)

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon successful completion of the Bachelor of Technology Program in Civil Engineering, the students should be able to:

1. Analyse and design foundation and superstructure for diverse building types using industry-standard software
2. Analyse and design hydraulic structures and transportation systems
3. Design and evaluate water, sewerage and industrial effluent conveyance and treatment systems
4. Conduct surveying, soil investigation, develop site maps, and schedule construction projects.

CURRICULUM STRUCTURE

SEMESTER-I									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	AST-101	Communication Skills	Theory	HSMC	2	2	0	0	2
2	ASB-101	Engineering Physics I	Theory	BSC	3	3	0	0	3
3	ASB-102	Engineering Chemistry	Theory	BSC	3	3	0	0	3
4	ASB-103	Engineering Mathematics I	Theory	BSC	3	3	0	0	3
5	EES-101	Basics of Electrical Engineering	Theory	ESC	3	3	0	0	3
6	CSS-101	Fundamentals of Computing	Theory	ESC	3	3	0	0	3
7	ASM-101	Environmental Science	Theory	MC-I	2	2	0	0	2
i	ASL-101	Language Laboratory	Lab	HSMC	1	0	0	2	2
ii	ASL-102	Engineering Physics Laboratory I	Lab	BSC	1	0	0	2	2
iii	ASL-103	Engineering Chemistry Laboratory	Lab	BSC	1	0	0	2	2
iv	MEL-104	Engineering Graphics & Design	Lab	BSC	2	0	0	4	4
				Total	**24**	19	0	10	29
SEMESTER-II									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	ASB-201	Engineering Physics II	Theory	BSC	3	3	0	0	3
2	ASB-202	Engineering Mathematics II	Theory	BSC	3	3	0	0	3
3	ASB-203	Biology for Engineers	Theory	BSC	3	3	0	0	3
4	ECS-201	Basics of Electronics & Communication Engineering	Theory	ESC	3	3	0	0	3
5	MES-201	Basics of Mechanical Engineering	Theory	ESC	3	3	0	0	3
6	CES-201	**Basics of Civil Engineering**	Theory	ESC	3	3	0	0	3
7	ASM-201	Constitution of India	Theory	MC-II (Audit)	0	2	0	0	2
i	ASL-201	Engineering Physics Laboratory II	Lab	BSC	1	0	0	2	2
ii	MEL-201	Workshop Practice	Lab	ESC	2	0	0	4	4
iii	MEL-202	Engineering Mechanics Laboratory	Lab	ESC	1	0	0	2	2
iv	CEL-201	Design Thinking & Idea Lab	Lab	ESC	1	0	0	2	2
				Total	**23**	20	0	10	30

SEMESTER-III									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	ASM-301	UHV	Theory	MC-III	3	3	0	0	3
2	ASM-302	Essence of Indian Traditional Knowledge	Theory	MC-IV	0	2	0	0	2
3	ASB-301	Engineering Mathematics III	Theory	BSC	3	3	0	0	3
4	CEC-301	**Solid Mechanics**	Theory	PCC	3	3	0	0	3
5	CEC-302	**Fluid Mechanics**	Theory	PCC	3	3	0	0	3
6	CEC-303	**Engineering Materials & Concrete Technology**	Theory	PCC	3	3	0	0	3
7	CEC-304	**Geomatics**	Theory	PCC	3	3	0	0	3
i	CEL-301	**Solid Mechanics Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-302	**Fluid Mechanics Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-303	**Engineering Materials & Concrete Technology Lab**	Lab	PCC	1	0	0	2	2
iv	CEL-304	**Geomatics Engineering Lab**	Lab	PCC	1	0	0	2	2
				Total	**22**	20	0	8	28
SEMESTER-IV									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEC-401	**Structural Analysis I**	Theory	PCC	3	3	0	0	3
2	CEC-402	**Hydraulics**	Theory	PCC	3	3	0	0	3
3	CEC-403	**Building Construction and Quantity Surveying**	Theory	PCC	3	3	0	0	3
4	AST-401	Operations Research	Theory	HSMC (OEC I)	3	3	0	0	3
5	AST-402	Economics	Theory	HSMC (OEC II)	3	3	0	0	3
i	CEL-401	**Structural Analysis Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-402	**Hydraulics Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-403	**Civil Engineering Drawing & CAD Lab**	Lab	PCC	1	0	0	2	2
iv	ASL-401	Numeric and Scientific Computing Lab.	Lab	ESC	2	0	0	4	4
				Total	**20**	15	0	10	25

SEMESTER-V									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEC-501	**Soil Mechanics**	Theory	PCC	3	3	0	0	3
2	CEC-502	**Water Treatment & Supply**	Theory	PCC	3	3	0	0	3
3	CEC-503	**Design of RCC Structures**	Theory	PCC	3	3	0	0	3
4	CEC-504	**Structural Analysis II**	Theory	PCC	3	3	0	0	3
5	CEC-505	**Design of Steel Structures**	Theory	PCC	3	3	0	0	3
6	CEE-50x	***CEE-501 Open Channel Flow/ Other PEC through SWAYAM (one PEC to be opted by students)***	Theory	PEC	3	3	0	0	3
i	CEL-501	**Soil Mechanics Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-502	**Water Treatment Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-503	**RCC Design & Drawing Lab**	Lab	PCC	1	0	0	2	2
iv	CEL-506	**Surveying Camp**	Lab	PCC	1	0	0	2	2
				Total	**22**	18	0	8	26
SEMESTER-VI									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEC-601	**Engineering Economics & Construction Management**	Theory	PCC	3	3	0	0	3
2	CEC-602	**Wastewater collection and Treatment**	Theory	PCC	3	3	0	0	3
3	CEC-603	**Transportation Engineering**	Theory	PCC	3	3	0	0	3
4	CEC-604	**Engineering Hydrology**	Theory	PCC	3	3	0	0	3
5	CEE-60x	***CEE-601 Advanced Structural Design I / other PEC through SWAYAM (one PEC to be opted by students)***	Theory	PEC	3	3	0	0	3
i	CEL-601	**Construction Management Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-602	**Wastewater Engineering Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-603	**Transportation Engineering Lab**	Lab	PCC	1	0	0	2	2
iv	CEL-605	**Civil Engineering Software Lab**	Lab	PCC	1	0	0	2	2
v	CEP-601	**Seminar**		PROJ	1	0	0	2	2
				Total	**20**	15	0	10	25

SEMESTER-VII									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEE-70x	***CEE-701 Foundation Engineering / other PEC***	Theory	PEC	3	3	0	0	3
2	CEE-70x	***CEE-702 Advanced Structural Design II / other PEC***	Theory	PEC	3	3	0	0	3
3	CEE-70x	***CEE-703 Irrigation Engineering/ other PEC***	Theory	PEC	3	3	0	0	3
4	CEE-70x	***CEE-704 Advanced Transportation Engineering / other PEC/ CEE-705 Building Services/ other PEC***	Theory	PEC	3	3	0	0	3
5	CEO-70x	***CEO-701 Construction Project Management / CEO-702 Computational methods in civil engineering / Other OEC through SWAYAM (one OEC to be opted by students)***	Theory	OEC	3	3	0	0	3
i	CEP-701	Summer Internship	Project-II	PROJ	2	0	0	4	4
ii	CEP-702	Project	Project-III	PROJ	3	0	0	6	6
				Total	**20**	15	0	10	25

SEMESTER-VIII									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEO-80x	***CEO-801 Environmental Pollution Control / CEO-802 Water Resources Engineering/ CE0-803 Earthquake Resistant Design/ CEO-804 Advanced Geomatics/ Other OEC through SWAYAM (two OECs to be opted by students)***	Theory	OEC	3	3	0	0	3
2	CEO-80x		Theory	OEC	3	3	0	0	3
i	CEP-801	Project	Project-IV	PROJ	6	0	0	12	12
				Total	**12**	6	0	12	18
				Grand Total	**163**				

* In case of semester long project work done in industry or internship, the OECs in VIII semester may be offered in online mode.
**Program electives would be offered subject to availability of minimum number of students (12) and teaching faculty

COURSE CODE	DEFINITIONS
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC-CE	Professional core courses
PEC-CE	Professional Elective courses
OEC-CE	Open Elective courses
LC-CE	Laboratory course
MC	Mandatory courses
PROJ-CE	Project

SEMESTER-I

COMMUNICATION SKILLS

AST- 101

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. gain proficiency in English
2. develop personality, communication fluency & accuracy
3. inculcate ideation and exposition skills
4. hone the interpretative, logical, creative and imaginative skills.
5. create human sensibilities and forge convergences of technology with larger humanity.

SYLLABUS

Unit-I: Communication Skills and its various aspects

Communication Skills: theoretical perspectives. Reading, Writing, Listening, Speaking and Pragmatics, Identification of Communication Barriers and ways to overcome them, Technology, Humanities & Communication

Unit-II: Grammar

Subject-verb agreement, Use of tense & sequence of tenses, Use of verbs, repositions & articles, Use of idioms & phrases, Discourse markers, Word vocabulary- synonym, antonym, homonym & one-word substitution

Unit-III: Writing

Formal & informal letters & Email correspondences, Report, Resume, Reviews (Book & Scientific) & Expansion, Essay & Article writing

Unit-IV: English Phonetics

Speech Mechanism, Organs of Speech, Vowels & Consonants, Place of Articulations, Manner of Articulation, Vowel diagram, IPA symbols, Phonetic Transcription, Word tress (Primary Accent)

Unit-V: Literature

Road Not Taken (Poem by Robert Frost), The Express (Poem by Stephan Spender), Of Studies (Essay by Francis Bacon), Pygmalion (by George Barnard Shaw)

Textbooks:

1. The Joy of Reading: Orient Blackswan Pvt. Ltd, New Delhi
2. Fluency in English: Macmillan Publishers, New Delhi
3. Intermediate Grammar Usage and Composition: M.L.Tikoo and Subramanian , Orient Blackswan Pvt. Ltd, New Delhi
4. A Textbook of English Phonetics for Indian Students: T. Balasubramanian, Macmillan Publishers, New Delhi.
5. Practical English Usage: Michael Swan, Oxford University Press.

Reference Books:

1. The Oxford Guide to effective Writing and Speaking Skills: John Seely, Oxford University Press
2. English Pronouncing Dictionary: Daniel Jones, Cambridge University Press.
3. Technical communication Principles and Practice: Meenakshi Raman and Sangeeta Sharma, Oxford

ENGINEERING PHYSICS- I

ASB- 101

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. introduce the basic theories of mechanics and kinematics.
2. describe the concepts of coordinate systems and their transformation. understanding the concept and applications of electric field intensity.
3. describe the basic laws of magnetism, analysis and their practical applications.
4. discuss the transition from classical to quantum mechanics, explaining quantum mechanics & related applications.
5. recall the basics of semiconductor, explaining various electrical parameter of semiconductors and different laws of distribution of particles. introducing the concept of free electron theory, its success and failure.

SYLLABUS

UNIT-I: Classical Mechanics

Review of Newtonian Mechanics in rectilinear Coordinate system, Rigid body, Translational and Rotational motion, Moment of Inertia, Radius of Gyration, Kinematics of rotational motion about fixed axis (Parallel axis theorem Perpendicular axis theorem), Simple harmonic motion (SHM), phaser representation of SHM, Simple Pendulum and Compound Pendulum, Damped harmonic oscillator- heavy, critical and light damping, energy decay in damped harmonic oscillator, quality factor.

UNIT-II: Electrostatics

Coordinate Systems: Cartesian, Cylindrical and Spherical, Transformation of coordinate systems, Gradient of a scalar, divergence and curl of a vector; line integral, surface integral and volume integral, Gauss Divergence Theorem and its applications, Stokes Theorem and its applications, Charge distribution along line, across surface and over volume, Gauss's law and its applications, Electric field due to uniformly charged infinitely long wire, Electric field due to thin infinite plane sheet, Electric field due to infinite parallel sheets, Electric field due to uniformly distributed charged spherical shell, Electric field due to non-conducting charged solid sphere, Working and principle of Potentiometer, Wheatstone bridge.

UNIT-III: Magnetostatics

Bio-Savart law and its application, Magnetic field due to current carrying conductor, Magnetic field at the centre and at the axis of circular coil carrying current, Magnetic flux, Gauss`s law in magneto statics, Ampere`s circuital law and its application, Magnetic induction due to long linear conductor, Magnetic field due to long circular cylinder, Equation of Continuity, Concept of Displacement current, Modified Ampere circuital law.

UNIT-IV: Quantum Ideas

Prerequisite of Quantum theory, Concept of Black body radiation, Wein`s displacement law, Rayleigh Jeans Planck`s hypothesis, wave particle duality; Photoelectric effect; de-Broglie hypothesis; Experimental evidence of matter waves (Davisson-Germer experiment), Compton effect, Uncertainty principle and its applications.

UNIT-V: Solid State Physics

Basic of semiconductors, Concept of doping in semiconductors, Intrinsic and Extrinsic semiconductors, p-type and n-type semiconductors. Effective mass and law of mass action, Carrier concentration, Electrical conductivity and mobility of charge carriers in intrinsic and extrinsic semiconductors. Classical free electron theory of metals and its failure, Explanation of electrical conductivity, thermal conductivity of metals, Weidmann Franz Law, Bose Einstein and Fermi Dirac statistical distribution function, Fermi energy of free electron in metal, concept of average energy and total energy of free electrons, relation between average energy and Fermi energy.

Textbooks:

1. Fundamentals of Physics: Halliday and Resnick
2. Introduction to Electrodynamics: David J. Griffiths
3. Optics: Ajoy Ghatak
4. Concepts of Modern Physics: Arthur Beiser

Reference Books:

1. Elements of Electrodynamics, Mathew N. O. Sadiku
2. Electricity, magnetism and Light, W. Saslow
3. Fundamentals of Optics, Jenkins and White

ENGINEERING CHEMISTRY

ASB- 102

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand basics of material science and surfactants.
2. understand the fundamentals of instrumental methods of analysis.
3. study and understand about chemical methods of analysis and phase rule.
4. develop an understanding of basics of electrochemistry.
5. understand about the fundamentals of polymers.

SYLLABUS

UNIT-I: Basics of Material Science and Surfactants

Types of crystal system, Bravais lattices, Miller indices, atomic packing factor, Planar atomic density, Crystal defects. Surface active agents: Soaps, Types and advantages. Detergents, Critical Micellar Concentration, Hydrophilic and Hydrophobic interactions, HLB values.

UNIT-II: Instrumental Methods of Analysis

Chromatography: Definition and its types, Adsorption chromatography, Partition chromatography, High Pressure Liquid Chromatography. Fundamentals of Spectroscopy: Principles and Applications of UV-Visible, Infra-Red and Atomic Absorption Spectrometry.

UNIT-III: Chemical Methods of Analysis and Phase Rule

Gravimetric Analysis: Digestion and its Importance, Favourable Conditions for Precipitation. Volumetric Methods of Analysis: Expression of concentration of solutions, Redox, Precipitation and Complexometric Titrations. Phase Rule and its applications to One and Multiple Component systems.

UNIT-IV: Electrochemistry

Reversible and Irreversible cell: Electrolytic and Galvanic cell, Electrode Potential, Standard Electrode Potential, EMF series, Nernst Equation, Cell emf Measurement. Thermodynamic Overview of Electrochemical Processes. Conductance, Cell Constant and its determination.

UNIT-V: Polymers

Fundamentals of polymer chemistry: Molecular weight, Glass transition temperature and Melting point. Methods of polymerization, Structure-property relationship, Thermoplastics and Thermosets. Fabrication of polymers by Compression, Injection, Extrusion and Transfer Moulding. Synthesis, properties and uses of common polymers, Conducting polymers and their applications.

Textbooks:

1. V. Raghvan, “Material Science and Engineering: A first Course”, Prentice Hall, 2006.
2. Jain and Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company.
3. Satyaprakash & Manisha Agrawal, “Engineering Chemistry”, Khanna Book Publishing, Delhi.
4. V. R. Gowarikar: “Polymer science”, New age international Publishers.

Reference Books:

1. William D. Callister, Jr and David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, Wiley, USA
2. Colin N. Banwell and Elaine M. McCash, Fundamentals of Molecular Spectroscopy, McGraw Hill Book Company Europe, England
3. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons
4. Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, Oxford University Press.
5. Robert J. Young and Peter A. Lovell, Introduction to Polymers, CRC Press, Taylor & Francis

ENGINEERING MATHEMATICS- I

ASB- 103

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. apply successive differentiation, expansion of functions, partial derivatives, double points and asymptotes.
2. do tracing of curve of two-dimensional, curvature, quadrature, rectification, volume and surface area of solids of revolutions.
3. apply theory of two variable calculus, eigen values, eigen vectors, consistency of system, vector space and linear transformations.
4. find the solution of ordinary differential equations with its applications.
5. learn the concepts of partial differential equations.

SYLLABUS

Unit-I: Calculus of One Variable and its Applications

Successive differentiation (Leibnitz's theorem of nth derivative), Maclaurin's and Taylor's expansion of a function.

Double point and its nature; Concavity, convexity and points of inflexion; Oblique and rectangular asymptotes, Curve tracing (Cartesian and polar forms), Curvature, Radius of curvature (Cartesian and polar forms)

Unit-II: Calculus of Several Variables and its Applications

Partial derivatives and their geometrical interpretation, Total derivative, change of variables, Euler's Theorem on Homogeneous Function, Taylor's expansion of a function of two and more variables; Leibnitz's rule for differentiation under the sign of integration; Maxima and minima of a function of two and more variables including Lagrange's method.

Unit-III: Integration and its Applications

Beta and Gamma Functions, Evaluation of multiple integrals by change of order of integration, applications of multiple integrals (Rectification, Volume and Surface of revolution)

Unit-IV: Ordinary Differential Equations and its Applications

Linear Differential Equations, Exact Differential Equations, complementary function and particular integral, solution of ordinary linear differential equations of higher order with constant and variable coefficients (Cauchy and Legendre forms); Orthogonal and isogonal trajectories of a family of curves.

Unit-V: Partial Differential Equations and its Applications

Introduction to partial differential equations, Lagrange's method of undetermined multipliers for the solution of linear partial differential equations of first order, solution of nonlinear partial differential equations of first order by means of Charpit's methods.

Textbooks/Reference Books:

1. Quddus Khan; Advanced Engineering Mathematics, Tyrasons Publications, Delhi-110092, (2022)
2. B. V. Raman, Higher Engineering Mathematics, McGraw Hill Education India, 26th edition 2016.
3. R. K. Jain and S. R. K. Iyengar: Advanced Engineering Mathematics Narosa, 5tr Edition, 2018.
4. H. K. Dass; Advanced Engineering Mathematics, S. Chand Publishing, 22nd edition, 2018.

BASICS OF ELECTRICAL ENGINEERING

EES- 101

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. solve electrical circuits applying kcl, kvl and network theorems.
2. understand the concept of phasors, waveforms and behaviour of basic electric circuit components.
3. analyze the various types of losses in magnetic circuits.
4. understand the construction, operation and applications of dc machines and single phase induction motors.
5. introduce various types of electrical machines and its applications

SYLLABUS

UNIT-I:

Kirchoff's laws, node voltage and mesh current methods, delta-star and star-delta conversion, classification of network elements, superposition principle, Thevenin's and Norton's theorems.

UNIT-II:

Single phase AC circuits, average and effective values of sinusoids, solution of R, L, C series circuits, the j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, solution of parallel and series-parallel circuits, resonance. Introduction to balance three phase AC circuits.

UNIT-III:

Introduction to magnetic circuits, analogy between electrical and magnetic circuit, Simple magnetic circuit with DC and AC excitations-Faraday's laws, induced emfs and inductances, magnetic leakages, B-H curve, hysteresis and eddy current loss, magnetic circuit calculations, mutual coupling.

UNIT-IV:

Single Phase Transformers- Principle of operation, construction, e.m.f. equation, ratings, phasor diagram for no-load and full load, equivalent circuit, power losses, regulation and efficiency calculations, open circuit and short circuit tests. Introduction to auto-transformer.

UNIT-V:

Types of electrical machines, working principle and construction of DC and AC machines, domestic and industrial applications of various types of electrical machines.

Textbooks:

1. V. Del Torro, Electrical Engineering Fundamentals, Second Edition, Prentice Hall of India Pvt. Ltd
2. R. L. Boylestad, Introductory Circuit Analysis, Pearson
3. I. J. Nagrath, Basic Electrical Engineering, McGraw-Hill Education (India) Pvt Limited

Reference Books:

1. S.S. Parker, Problems in Electrical Engineering, Asia Publishing House.
2. H. Cotton, Advanced Electrical Technology, Pitman, London
3. T. L. Floyd, Principles of Electric Circuits, Pearson
4. E. Hughes, Electrical & Electronic Technology, Revised by John Hiley, Keith Brown and Ian Mckenzie Smith, Pearson

FUNDAMENTALS OF COMPUTING

CSS- 101

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand the basics of computer, generation and types of computer and number system.
2. understand the concept of algorithms, flowchart and c programming basics.
3. implement loops and array in c programming.
4. apply the concepts of searching and sorting techniques in c programming.
5. describe different types of operating systems and its functions and they will understand basics of computer networking and internet.

SYLLABUS

UNIT-I: Basics of Computers

Computer fundamentals, Bits and Bytes, CPU, Memory, Types of memory, Input and output devices, Operating system, application software, system software, generation of computer, classification of computer Number system: decimal number system, binary number system, octal number system, hexadecimal number system.

UNIT-II: Introduction to C Programming

Introduction to Programming Language, Compiler, Interpreter, Algorithms, flow chart, C character set, C-tokens: constants, variable, keywords, Data types, operator and expressions. Decision controls: if-else, if-else ladder, nested if-else, conditional operator, switch case.

UNIT-III: Loop and Array

For loop, while loop and do-while loop, continue and break statement, Function: inbuilt and user defined functions, call by value and call by reference, Array: Single dimensional array. 2D array, multidimensional array, Operations on array.

UNIT-IV: Searching and Sorting

Pointers, searching and sorting, Searching techniques: linear search, binary search, Sorting techniques: bubble sort, selection sort, Strings, library string functions.

UNIT-V: Operating System & Networking

OS definition, role of OS in computer system, multi programming, time sharing OS, multitasking OS, multiprocessing OS, real time system OS, client server computing, distributed OS, functions of OS. Computer Network, transmission media, network topologies, LAN, WAN, MAN, Internet, ISP, WWW, Email, URL, Web browsers, websites, intranet. Latest technologies in IT.

Textbooks /Reference Books:

1. Herbert Schildt C-The Complete Reference., Tata McGraw Hill Edition
2. Ritchie, D. M., Kernighan, B. W., & Lesk, M. E. (1988). The C programming language. Englewood Cliffs: Prentice Hall.
3. Kamthane, A. N. (2011). Programming in C, 2/e. Pearson Education India.
4. Doja, M. N. (2005). Fundamentals of Computers and Information Technology
5. Yashwant, K. Let us C. 8th edition, BPB publication.
6. Balagurusamy, E. (2012). Programming in ANSI C. Tata McGraw-Hill Education.

ENVIRONMENTAL SCIENCE

ASM-101

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand different natural resources and concepts of their conservation
2. understand concept of ecology and different types of ecosystem
3. understand concept of biodiversity and its conservation
4. understand different types of environmental pollution and their preservation
5. understand various societal and environmental issues

SYLLABUS

UNIT-I:

Renewable and non-renewable resources, Forest resources, Water resources, Mineral Resources, Food Resources, Energy Resources, Land Resources, Role of individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT-II:

Concept of an eco-system, Structure and function of an eco-system, Producers, consumers, decomposers, Energy flow in the eco systems, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following eco systems: Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT-III:

Introduction-Definition: genetics, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local level, India as a mega diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts, Endangered and endemic spaces of India, Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT-IV:

Definition Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: Floods, earth quake, cyclone and landslides.

UNIT-V:

Concept of sustainable development, Urban problems related to energy, Water conservation, rainwater harvesting, Environmental ethics: issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, case studies, Wasteland reclamation, Consumerism and waste products, Introduction to environmental legislations and public awareness.

Textbooks/Reference Books:

1. S.C. Sharma, “Environmental Engineering”, Khanna Publishing House
2. R.C. Gaur, “Basic Environmental Engineering”, Newage Publications
3. P.N. Modi, “Water Resources Engineering”, Standard Publishers
4. Dr. A.K. Jain, “Environmental Engineering”, (ISBN: 978-93-86173560), Khanna Publishers

SEMESTER-II									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	ASB-201	Engineering Physics II	Theory	BSC	3	3	0	0	3
2	ASB-202	Engineering Mathematics II	Theory	BSC	3	3	0	0	3
3	ASB-203	Biology for Engineers	Theory	BSC	3	3	0	0	3
4	ECS-201	Basics of Electronics & Communication Engineering	Theory	ESC	3	3	0	0	3
5	MES-201	Basics of mechanical Engineering	Theory	ESC	3	3	0	0	3
6	CES-201	**Basics of Civil Engineering**	Theory	ESC	3	3	0	0	3
7	ASM-201	Constitution of India	Theory	MC-II (Audit)	0	2	0	0	2
i	ASL-201	Engineering Physics Laboratory II	Lab	BSC	1	0	0	2	2
ii	MEL-201	Workshop Practice	Lab	ESC	2	0	0	4	4
iii	MEL-202	Engineering Mechanics Laboratory	Lab	ESC	1	0	0	2	2
iv	CEL-201	Design Thinking & Idea Lab	Lab	ESC	1	0	0	2	2
				Total	**23**	20	0	10	30

SEMESTER-II

ENGINEERING PHYSICS- II

ASB- 201

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. conceptualize two frames, applying the theory relativity in describing the motion of high speed objects.
2. understand the phenomena of light. introducing lasers and its working principle for various applications.
3. discuss the theories of electromagnetism, validating maxwell's equations and applying these equations to verify the properties of EM wave
4. introduce wave functions, its properties and applications. understanding Schrodinger equations and solving related problem.
5. apply quantum ideas to solids. discussing the origin of energy gap and applying quantum mechanical approach to free electron theory and band theory of solids.

SYLLABUS

UNIT-I: Special Theory of Relativity

Inertial and non-inertial frame of reference, Galilean transformations of position, velocity and acceleration and it`s invariance, Concept of Ether, Michelson Morley Experiment, Postulates of special theory of relativity, Lorentz transformations of position, Time Dilation, Length contraction, Einstein velocity addition theorem, Relativistic mass, momentum and energy.

UNIT-II: OPTICS & LASERS

Introduction of interference and diffraction, Interference in Thin film (Interference due to reflected and transmitted light), Interference in Wedge-Shaped film, Newton`s Rings experiment, Newton`s rings by reflected and transmitted light, Determination of wavelength of sodium light using Newton`s Rings. Introduction of Laser, General characteristics of lasers, Applications of Lasers. Principle of Lasing action, Concept of Population Inversion, Einstein's transition probabilities, Basic idea of Optical resonator, Working and Principle of Ruby Laser, He-Ne laser.

UNIT-III: Electromagnetism

Maxwell`s equation: Integral and differential form and their physical significance, Wave equation in terms of Electric and Magnetic field, Propagation of Electromagnetic waves (EM) in free space and its transverse characteristic, Flow of energy, Poynting vector, Energy density in electromagnetic waves.

UNIT-IV: Quantum Mechanics

Wave function and its significance, properties of wave function, Normalization, Orthogonal, Orthonormal and probabilistic interpretation. Position operator, momentum operator and energy operator, Eigen values and eigen functions, Expectation value of position, momentum and energy. Derivation of Schrodinger time dependent and independent equation for wave function. One-dimensional problem- confinement of particle in a box, wavefunction, energy eigenvalues.

UNIT-V: Physics of Materials

Quantum free electron theory, Sommerfeld Model, Merits of Quantum free electron theory, Density of states, Wavefunctions and Energy of free electrons in metals, Electrons in periodic potential, Bloch theorem, Kronig Penney model, Band theory of solids, Origin of Energy band gap in solids, Quantum aspect of Hall's Effect.

Textbooks:

1. Concepts of Modern Physics: Arthur Beiser
2. Quantum Mechanics, Concept and Applications: Nouredine Zettili.
3. Introduction to Electrodynamics: David J. Griffiths
4. Optics, A. Ghatak
5. Electronic Fundamentals and Applications: J. Milliman and Christos C. Halkias

Reference Books:

1. Principles of Lasers: O. Svelto
2. Fundamentals of Physics: Halliday and Resnick

ENGINEERING MATHEMATICS- II

ASB- 202

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. do tracing of 3d curves, evaluation of multiple integrals by change of order of integration, change of variables.
2. apply series solution and applications of partial differential equations.
3. do study of analytical functions, expansion of complex functions, zeros and singularities of functions, theory of residues, evaluation of contour integrals and conformal mappings.
4. apply Laplace transform and is applications in solving differential and integral equations.
5. apply learning theory and applications of fuzzy mathematics.

SYLLABUS

Unit-I: Solid Geometry and Applications of Multiple Integrals

Formation of equations of cylinder and cone under the given geometrical conditions. Applications of multiple integrals in finding mass, centre of gravity, centre of pressure, moment of inertia, product of inertia, curved surface area and volume.

Unit-II: Series Solution and Applications of P.D.E.

Ordinary point, regular singular point, series solutions of ordinary differential equations of second order, Frobenius method for the solution of O.D.E.

Unit-III: Complex Analysis and its Applications

Complex function, Analytical function, C-R equations (Cartesian and polar forms), Milne - Thomson method and related problems; Evaluation of complex integrals using Cauchy's integral theorem, Cauchy's integral formula, conformal mapping, Zeros, singularities and residues of an analytic function; Application of Cauchy's residue theorem in solving contour integrals and evaluation of real definite integrals using residue method.

Unit-IV: Laplace Transform and its Applications

Notion of Laplace transform and its properties, Laplace transform (some well-known elementary functions and Special functions), Inverse Laplace transforms and its properties (some well-known elementary functions and Special functions), Laplace transforms of Derivative, Integral, Convolution theorem. Applications of Laplace and inverse Laplace transform in finding the particular solutions of ordinary linear differential equations with constants and variables coefficients, system of differential equations, integral equation, Integra-differential equations.

Unit-V: Tensor Analysis and its Applications

Notion of tensors, operations on tensors (Addition, subtraction, multiplication and contraction), Types of tensors (reciprocal tensors, Fundamental tensors, Relative tensors, symmetric and skew symmetric tensors), Christoffel symbol and its properties.

Textbooks/ Reference Books:

1. Quddus Khan; Advanced Engineering Mathematics, Tyrasons Publications, Delhi-110092, (2022)
2. B. V. Raman, Higher Engineering Mathematics, McGraw Hill Education India, 26th edition 2016.
3. R. K. Jain and S. R. K. Iyengar: Advanced Engineering Mathematicsl Narosa, 5tr Edition, 2018.
4. H. K. Dass; Advanced Engineering Mathematics, S. Chand Publishing, 22"" edition,2018.

BIOLOGY FOR ENGINEERS

ASB- 203

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand the concept of nanotechnology
2. learn the applications of nanotechnology in multiple disciplines
3. understand the concepts of biological sciences, genetics, biological indicators and biosensors
4. explore the field of advanced biological sciences and biotechnology
5. explore nano-biotechnology and its various applications

SYLLABUS

UNIT-I: Introduction to Nanotechnology

Introduction to Nanotechnology, Theoretical Basis of nanotechnology, Quantum confinement and size effect, Classification of Nanomaterials: Nanowires, Quantum Well and Quantum Dots, Properties of Nanomaterials, Carbonaceous Nanomaterials and their examples. Molecular Nanotechnology, Green Nanotechnology.

UNIT-II: Fundamentals of AI, Data Science, and Machine Learning

AI Introduction, Applications in Engineering, Types & Subfields, Ethical Considerations. Data Science Overview, Significance in Engineering, Components, Data Types, Tools & Languages. Python Fundamentals: Variables, Data Types, Control Structures. Machine Learning Introduction, Types, Workflow, Popular Algorithms, Python for ML. Practical AI Applications in Engineering: Automation, Maintenance, Computer Vision, NLP, Optimization. Case Studies.

UNIT-III: Introduction to Biological Sciences

Darwinian evolution & molecular perspective; Introduction to phylogeny -Classification systems in biology and relationships; Cellular assemblies – From single cell to multi – cellular organisms: Geometry, Structure and Energetics; Comparing natural Vs human-made machines, Chromosomes and Cell Division. Basic Genetics-biological indicators, Mutation-causes. types and effect.

UNIT-IV: Basics of Microbiology & Immunology

Introduction to microbiology, Introduction to immunology, Immunology – A classic example of permutations and combinations in biology; Concept of Gene, Gene regulation, Infection, disease and evolution – synergy and antagonism; Cancer biology – Control and regulation; Stem cells – Degeneracy in biological systems; Engineering designs inspired by biology – Micro – to Macro – scales.

UNIT-V: Biotechnology

Basic concepts of biotechnology: Totipotency and cell manipulation, Classifications of biotechnologies, Bioprocessing Technologies, Imaging techniques, Electrophysiology, Introduction to Nanobiotechnology, Regenerative medicine, Targeted drug delivery. Nanoimaging, Cancer treatment using Nanotechnology, Nanotoxicology: basics of cellular and organ level toxicity.

Textbooks/Reference Books:

1. B. S. Murthy, P. Shankar, B. Raj, J. Murday, “Text Book of Nanoscience& Nanotechnology”, Universities Press Springer.
2. Tom Taulli, “Artificial Intelligence Basics: A Non-Technical Introduction”, A Press.
3. Python Learning, Lutz Mark Reilly Media publishers, 5th Edition.

BASICS OF ELECTRONICS & COMMUNICATION ENGINEERING

ECS- 201

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. become familiarize with the semiconductor diodes and various logic gates
2. analyze biasing, load line and amplifier action of transistor
3. design various operational amplifier circuits
4. explain oscillators, cro and electronics multi-meters
5. become familiarize with various schemes of modulation

SYLLABUS

UNIT I: Semiconductor Diodes

P-N Junction diode, V-I characteristics, static and dynamic resistance, linear and non-linear applications of diodes, half wave, full wave and bridge rectifiers, Zener diode, characteristics and its use as a voltage regulator. AND, OR, NAND, NOR and Ex-OR gates.

UNIT II: Transistors (BJT & JFET)

Bipolar junction transistor (BJT), biasing and amplifier action, load line analysis of transistor amplifier, BJT amplifier configurations, Junction field effect transistor (FET), biasing and amplifier action.

UNIT III: Operational Amplifier

Op-amp basics, practical op-amp circuits, inverting and non-inverting amplifier, summing amplifier, integrators and differentiators.

UNIT IV: Feedback and Electronic Instruments

Feedback concept, Barkhausen Criteria of oscillation, Wein bridge and phase shift oscillator, cathode ray oscilloscope (CRO), electronics multi meters.

UNIT V: Communication Systems

Introduction to modulation, amplitude modulation, generation of AM waves, demodulation of AM waves, introduction to FM.

Textbooks:

1. J. Millman and A. Grabel, 'Microelectronics' 2nd Edition, McGraw Hill, International Edition, 1988.
2. Robert Boyles tad and Louis Nashlesky, 'Electronic Devices and Circuit Theory' 5th Edition, PHI, 1992.

Reference Books:

1. Schilling and Beloved, 'Electronic Circuits-Discrete and Integrated', McGraw Hill International Edition, 1988.
2. Simon Haykin, 'Communication Systems', 2nd Edition, Wiley Eastern Ltd, New Delhi, 1992

BASICS OF MECHANICAL ENGINEERING

MES- 201

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. apply the basic laws of thermodynamics in engineering system for analysis.
2. understand the concepts of fluid mechanics and recognize the various types of problem when the fluid is at rest or in motion.
3. analyze the real time applications of heat transfer and describe the fundamental modes of heat transfer.
4. apply the principle of impulse and momentum to solve three-dimensional rigid body kinetics problems including gyroscopic motion.
5. determine the inversions of kinematic chain and degrees of freedom of a mechanism.

SYLLABUS

UNIT-I: Thermodynamics

Introduction to Thermodynamics, Concepts of systems, control volume, state, properties, Equilibrium, quasi-static process, reversible & irreversible process, cyclic process. Zeroth Law and Temperature Heat and Work, First Law of Thermodynamics for closed & open systems. Non-Flow Processes, numerical based on the above concepts Energy Equation. Steady Flow Energy Equation. Numerical based on SFEE. Second Law of Thermodynamics-Kelvin and Plank's and Clausius Statement.

UNIT-II: Fluid Mechanics

Introduction, fluid properties, basic equation of fluid statics pressure variation in a static fluid, hydro-static force on submerged surfaces buoyancy and stability fluids in rigid-body motion Introduction to fluid dynamics

UNIT-III: Heat Transfer

Heat Transfer: What and how?

Application areas of heat transfer, historical background, Physical origin and heat transfer mechanism/Modes of heat transfer: Conduction, Convection and Radiation, Fourier's law of heat conduction, Thermal conductivity of materials Thermal resistance, General heat conduction equation, Newton's law of cooling, Surface emission properties: absorptivity, reflectivity and transmissivity, Concept of a black body, The Stefan-Boltzmann law and Kirchhoff 's law, problems

UNIT-IV: Dynamics of Rigid Bodies

Angular momentum of a rigid body in three dimensions, Application of the principle of impulse and momentum to the three-dimensional motion of a rigid body, Kinetic energy of a rigid body in three dimensions, Motion of a rigid body in three dimensions, Euler's equations of motion, Motion of a rigid body about a fixed point, Rotation of a rigid body about a fixed axis, Motion of a gyroscope. Eulerian angles, Steady precession of a gyroscope.

UNIT-V: Basic Concept of Mechanisms and Machines

Link, kinematic pairs and their classifications, Kinematic chain, Mechanism and their inversions. Degree of Freedom of a mechanism, Four bar chain and its inversions, Single and double Slider-crank chains, Quick return motion mechanisms, Mobility of four bar linkage (Grashof criterion), Power Transmission systems: Gear Drives, belt drives, chain drives, friction drives

Textbooks:

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill 2005
2. Vijay Gupta & Santosh K Gupta, Fluid Mechanics and Its Applications, Third Edition, New Age International, 2017
3. Sachdeva, R.C., Fundamentals of Heat and Mass Transfer, 4th ed., New Age International, 2012
4. Ferdinand P. Beer, E. Russell Johnston, Jr., David F. Mazurek, Phillip J. Cornwell, Brian P. Self, Vector Mechanics for Engineers: Statics and Dynamics, Twelfth Edition, McGraw Hill Education.
5. Ghosh & Mallick, Theory of Mechanisms and Machines, EWP

Reference books:

1. Fundamentals of Classical Thermodynamics, G. J. Van Wylen and R. E. Santag
2. Fox & McDonald, Introduction to Fluid Mechanics, Fifth Edition, John Wiley & Sons, Inc. 2004

BASICS OF CIVIL ENGINEERING

CES- 201

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand civil engineering disciplines and types of structures.
2. comprehend various infrastructure systems.
3. understand different materials and equipment used in Civil Engineering.
4. describe elements of buildings.
5. interpret material properties and deformations.

SYLLABUS

UNIT-I:

Introduction to Civil Engineering; Civil Engineering Disciplines; Different Civil Engineering structures (Only Types): Buildings, Bridges, Aqueducts and viaducts, Towers and Chimneys, Tunnels, Dams, Retaining Walls, Water Tanks, Coastal defences: Sea wall, Breakwaters, Gabions.

UNIT-II:

Roadways, Railways, Airports, Docks and Harbours, Water Supply Systems, Sewage Systems, Solid Waste Management Systems, Power Supply Systems, Emergency Systems.

UNIT-III:

Materials: Cement, Steel, Stones, Different type of Bricks and Blocks, Timber, Mortar, Concrete; Equipment: Excavator, Earth mover: Bulldozer, Roller Compactor: Road Rollers, Concrete Mixer, Vibrators, Non-destructive Testing Equipment, Surveying and Surveying equipment.

UNIT-IV:

Substructure and Superstructure, Footings/Foundations: Open foundation, wall foundation, Isolated, Combined, Strap, Mat/ Raft, Piles, Well, Piled-Raft; Storey, Plinth, Floor, Wall, Column, Beam, Slab, Ceiling, Cantilever, Stairs; Lifts, Ramps, Sanitary fixtures and Plumbing appurtenances.

UNIT-V:

Uniaxial Tension Test: Stress-Strain Diagrams for Different Materials, Elasticity, Yielding, Work Hardening, Plasticity; Normal Stress &Normal Strain, Shear Stress & Shear Strain, Stress-Strain Relationship; Elastic Constants and their inter-relationships, Uniaxial Deformations.

Textbooks/ Reference Books:

1. Basic Civil Engineering by Satheesh Gopi, Pearson
2. Basic Civil Engineering by Punmia, Jain & Jain, Laxmi Publication
3. Mechanics of Materials by R. C. Hibbler, Pearson Publication. Building Materials by S. K. Duggal, New Age Press
4. Mechanics of Solid by Abdul Mubeen, Pearson, Pearson Education
5. Infrastructure Engineering and Construction Techniques by Lad, Kulkarni, Patil, Minde, Apte, Phadke, Nirali Prakashan

CONSTITUTION OF INDIA

ASM- 201

L: 3 T: 0 P: 0 Cr: 0

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand the history and structure of the Indian constitution and its important parts.
2. understand the features and preamble of constitution of India.
3. develop an awareness of the fundamental rights and duties as a responsible citizen of India.
4. explore how different parts of the government like the president, the prime minister, parliament, state governments and judiciary work together to govern the country.
5. develop the knowledge of elections and activities of elections commission of India.

SYLLABUS

UNIT-I: Introduction

Constitution of India: Sources, interpretation and constitutional history, salient features of the constitution

UNIT-II: Features and Preamble of the Constitution of India

The Preamble of the constitution, socialism, secularism, democracy, republican charter, justice, liberty, equality, fraternity, dignity of the individual, unity and integrity of the nation.

UNIT-III: Citizenship and the Fundamental Rights of the Citizens of India.

Citizenship, fundamental rights of a citizen: right to equality, right to freedom, right against exploitation, right to freedom of religion, cultural and educational rights, right to constitutional remedies, fundamental duties of a citizen.

UNIT-IV: The Union and State Legislatures and the Judiciary

The union executives: The President, The Vice President, Council of Ministers, The Prime Minister, Attorney General of India. The Union Legislature: The Parliament and Parliamentary proceedings. The Judiciary - The Supreme Court, The High Court and the subordinate courts: its powers and functions. The states and union territories, Union-State relations.

UNIT-V: Elections, Functions and Role of Election Commission.

Elections: electoral reforms. The Election Commission – role of chief election commissioner, power and functions of the Election Commission of India. Amendment of the Constitution. Panchayti Raj. Working of the Constitution.

Textbooks:

1. Subhash C Kashyap, Our Constitution, National Book Trust, India 2012

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd. New Delhi 2014
2. J.A. Siwach, Dynamics of Indian Government & Politics, 2nd Edition 2016

SEMESTER-III									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	ASM-301	UHV	Theory	MC-III	3	3	0	0	3
2	ASM-302	Essence of Indian Traditional Knowledge	Theory	MC-IV	0	2	0	0	2
3	ASB-301	Engineering Mathematics III	Theory	BSC	3	3	0	0	3
4	CEC-301	**Solid Mechanics**	Theory	PCC	3	3	0	0	3
5	CEC-302	**Fluid Mechanics**	Theory	PCC	3	3	0	0	3
6	CEC-303	**Engineering Materials & Concrete Technology**	Theory	PCC	3	3	0	0	3
7	CEC-304	**Geomatics**	Theory	PCC	3	3	0	0	3
i	CEL-301	**Solid Mechanics Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-302	**Fluid Mechanics Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-303	**Engineering Materials & Concrete Technology Lab**	Lab	PCC	1	0	0	2	2
iv	CEL-304	**Geomatics Engineering Lab**	Lab	PCC	1	0	0	2	2
				Total	**22**	20	0	8	28

SEMESTER-III

UNIVERSAL HUMAN VALUES (UHV)

ASM- 301

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand and analyse the essentials of human values and skills, self-exploration, happiness and prosperity.
2. evaluate coexistence of the "I" with the body.
3. identify and evaluate the role of harmony in family, society and universal order.
4. understand and associate the holistic perception of harmony at all levels of existence.
5. develop appropriate technologies and management patterns to create harmony in professional and personal lives.

SYLLABUS

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; Personality Traits- Self Excellence, Natural Acceptance and Experiential Validation- as the process for self-exploration, Adaptability, Belief and Understanding- Self discipline
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
7. Myers-Briggs Type Indicator (MBTI) Personality test

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient "I" and the material "Body".
2. Understanding the needs of Self ("I") and "Body" - happiness and physical facility
3. Understanding the Body as an instrument of "I" (I being the doer, seer and enjoyer)- Habits and Hobbies, SWOT Analysis (Activity)
4. Understanding the characteristics and activities of "I" and harmony in "I" – Dalai Lamas‟ Tibetan Personality Test – Dr. Menninger's Psychometric Test.
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.
7. Epidemiology- Definition of health, Social and Preventive Medicine, Personal hygiene and handling stress, WHO Guidelines

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Friends and Foes, Empathy, False Prestige.

4. Concept of an Ideal family- Marriage as an Institution
5. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society, Universal Human Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students‟ lives

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature and its Equanimity, Respect for all, Nature as Teacher
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Vision for the Holistic alternatives, UHVs for entrepreneurship
7. Strategy for transition from the present state to Universal Human Order: (a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers (b) At the level of society: as mutually enriching institutions and organizations – Right understanding and dilemmas of professional ethics in today‟s world.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Textbook:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

ASM- 302

L: 2 T: 0 P: 0 Cr: 0

COURSE OUTCOMES

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system. Understanding of modern science and Indian traditional knowledge. Understanding traditional healthcare though Yoga and Sufism. Using the traditional knowledge in the field of engineering and technology. Understanding of Indian Traditional Knowledge and its benefits in today's scenario through case studies.

SYLLABUS

Course Description:

Introduction to Indian traditional knowledge system, nature, characteristics, scope and importance. Schools of ancient Indian education, Nalanda, Taxshshila and other centres of learning. Kautilya's classification of schools (त्रायी, वार्ाा, दंड नीतर्, अन्वेतिकी). History of Ayurveda (आयुवेद), importance and scope. Ancient Indian Architecture (प्राचीन भारर्ीय वास्तुकला), importance, historical and modern perspective. Astronomy (खगोल शास्त्र) and Vedic Astrology (वैतदक ज्योतर्ष). History, importance and significance in present holistic healthcare (समग्र स्वास्थ्य सेवा). Role of Sufism, dhyaan, music and poetry, importance and historical perspective. Understanding planetary movements, solar centric world, shape and diameter of earth, ancient Indian education in science and technology. Case Studies.

Textbooks/ Reference Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
3. Knowledge Traditions and Practices of India by Kapil Kapoor and Michel Danino.

ENGINEERING MATHEMATICS III

ASB- 301

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. demonstrate the application of gauss divergence, stoke, and green theorems
2. understand the concept of probability and statistics
3. apply Fourier transforms to integral equations
4. apply z-transforms to the difference equations
5. diagnose the nature of the series.

SYLLABUS

Unit-I: Vector Calculus and its Applications

Scalar and vector function, gradient of a scalar field, divergence of a vector field, Curl, Gauss divergence theorem, Green's Theorem, Stoke's Theorem and related problems based on them

Unit-II: Linear Algebra and its Applications

Consistency of a system of simultaneous linear equations using rark, Eigen values and Eigen vectors of a square matrix, Cayley-Hamilton theorem and its applications, vector space, basis, linear dependence and independence of vectors, Linear transformations and related problems based on them.

Unit-III: Fourier Series, Fourier Transforms and its Applications

Fourier's series (full range and half range) for arbitrary period, Representations of a function in terms of Fourier integral, Fourier Sine integral and Fourier Cosine integral, Inverse Fourier transforms, Application of Fourier transform

Unit-IV: Difference Equations, Z-Transforms and its Applications

Difference Equations, Formation of Difference equations, order of Difference equations, Linear Difference equations and its solutions, Z-Transforms and its properties, Z-Transforms of some elementary functions, inverse Z-transforms, Convolution theorem for Z-Transform, Application of Z-Transform in solving difference equations

Unit-V: Probability and Statistics

Probability theorems, Probability distribution (Binomial distribution, Poisson and Normal distributions), Moment, Skewness, Kurtosis, Rank of correlation

Textbooks/ Reference Books:

1. Quddus Khan; Advamced Engineering Mathematics, Tyrasons Publications, Delhi-110092, (2022)
2. B. V. Raman, Higher Engineering Mathematics, McGraw Hill Education India, 26th edition 2016.
3. R. K. Jain and S. R. K. Iyengar: Advanced Engineering Mathematical Narosa, 5tr Edition, 2018.
4. H. K. Dass; Advanced Engineering Mathematics, S. Chand Publishing, 22nd edition,2018.

SOLID MECHANICS (PCC)

CEC- 301

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. apply the concept of stress and strain for analyzing different structural members.
2. draw shear force, bending moment, axial force diagrams for beams and brackets and analyze trusses using method of joints and sections.
3. apply theory of pure bending to determine stresses in different types of structural elements
4. analyze behavior of cylindrical shells and shafts
5. analyze compression members under axial and eccentric loading.

SYLLABUS

UNIT-I:

Stress: Tensor notations, equilibrium equations, transformation of stresses, invariants of stress tensor, plane stress condition, principal stresses, maximum shear stress and their planes, Mohr's circle.

Strain: Transformation of strains, invariants of stain tensor, plane strain condition, principal strains, maximum shear strain and their planes; Strain Rosettes; Stress –Strain relationship, generalized Hooke's law

UNIT-II:

Loads, idealization of structures, supports and connections, elastic and linear behavior of structures. SF and BM: Relation between B.M., S.F. and loads, Diagrams for cantilevers, simply supported, over-hanged and cantilever beams subjected to concentrated load, UDL, moments and varying loads; SF, BM Diagrams for inclined beams & brackets subjected to concentrated load, UDL, moments and varying loads. Analysis of statically determinate trusses–introduction, method of joints and method of sections.

UNIT-III:

Bending theory, bending equation, bending stresses in rolled steel and built-up sections; Shear stresses in beams: shear flow, shear center, variation of shear stresses in beam cross-section. Unsymmetrical Bending: Introduction, Double symmetric beams with skew loads.

UNIT-IV:

Thin and Thick Cylinders: Longitudinal and hoop stresses, volumetric strains; Torsion: Circular shafts, power transmitted by shafts.

UNIT-V:

Concept of strain energy and resilience; Theories of failure, Columns and struts subjected to compression and bending, middle third & middle fourth rules, core or kernel of sections, masonry column, dams and retaining walls; Long columns: Euler's, Rankine's and Secant formulae.

Textbooks:

1. Strength of Materials by S. Timoshenko, CBS Publisher

Reference Books:

1. Mechanics of Materials by Beer & Jonhson, DeWolf, McGraw HILL.
2. Strength of Materials by R. K. Rajput, S Chand
3. Engineering mechanics of solids, E. P. Popov, Pearson Education.
4. Solids Mechanics, S. M. A. Kazimi, Tata McGraw HILL.
5. Mechanics of Materials, R. C. Hibbeler, Pearsons.

FLUID MECHANICS (PCC)

CEC-302

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. develop relationships between different fluid properties and apply them to practical problems
2. analyze the pressures variation law and stability of floating and submerged bodies.
3. apply the concepts of kinematics to solution of fluid flow problems.
4. apply the concepts of rotational mechanics for the analysis of free and forced vortex motion
5. apply Bernoulli's energy equation to solve real world problems

SYLLABUS

UNIT-I:

Introduction: Real and ideal fluids, concept of continuum approximation, properties of fluids, equation of state, coefficient of compressibility, bulk modulus of elasticity, Newtonian and non- Newtonian fluid, surface tension, capillarity, concept of viscosity, effect of temperature on viscosity.

UNIT-II:

Fluid Static: Pascal's law, devices based on Pascal's law, hydrostatic law, pressure variation in isothermal and adiabatic condition; Manometers: Simple and differential manometers, relative equilibrium; Forces on submerged plane, inclined and curved surfaces; Buoyancy; Stability of floating and submerged bodies, meta centre and meta centric height.

UNIT-III:

Fluid Kinematics: Kinematics of fluid Motion, Eulerian and Lagrangian description, type of motion, concept of control volume and control surface, streamline, path line, streak line and stream tube, continuity equation in Cartesian coordinate and polar coordinate, one- and two-dimensional flows, acceleration of fluid element, linear momentum equation and its application- forces on pipe bends.

UNIT-IV:

Fluid Rotation: Circulation and Vorticity, angular velocity in terms of velocity field, irrotational flow, velocity potential and stream function, flow net and its uses, free and forced vortex motion. Potential flow.

UNIT-V:

Fluid dynamics: Navier- Stoke's equation, Euler's equation of motion and integration along streamline; Bernoulli's equation, physical significance of different heads, Bernoulli's equation for isothermal and adiabatic flow; Application of Bernoulli's equation: pitot tube, venturi meter, orifice meter, Concept of kinetic energy, and momentum correction factors; Flow through an orifice; Time required for emptying of tank.

Textbooks/ Reference Books:

1. Frank. M. White, Fluid Mechanics, McGraw-Hill, 7th edition, 2011.
2. John F. Doughlas, Janusz M. Gasiorek, John A. Swaffield, and Lynne B. Jack. Fluid Mechanics, Pearson, 2012
3. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, Fundamentals of Fluid Mechanics, 5th Edition, John Wiley and Sons, 2006
4. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid Mechanics, Wiley, 6th ed., 2003
5. A. K. Jain Fluid Mechanics, Standard Publishing House, Delhi

ENGINEERING MATERIALS & CONCRETE TECHNOLOGY (PCC)

CEC- 303

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand the properties of different types of cement.
2. conduct tests on cement aggregate and concrete & concrete mix proportioning.
3. use different types of special concrete in construction.
4. identify useful properties of bricks, stones, and other materials.
5. identify properties of different types of rocks and understand causes of seismic activities.

SYLLABUS

UNIT-1:

Types of cement, hydration mechanism and products, setting and hardening, curing, strength of cement, grade of cement, tests on cements, fly ash and other supplementary cementitious materials, BIS codes: IS 455, IS 269, IS 1489.

UNIT-II:

Properties of coarse & fine aggregates, tests on aggregates, BIS codal provisions: IS 456, IS 4031, Concrete: Ingredient of concrete, properties of fresh and hardened concrete, strength of concrete, workability of concrete and its tests, W/C ratio, additives, concrete mix proportioning.

UNIT-III:

Light weight concrete, fibre reinforced concrete, light weight concrete, roller compacted concrete, ready mix concrete, self-compacting concrete, high performance concrete, micro concrete, bacterial concrete, polymer concrete, Ferrocement.

UNIT-IV:

Forms of bricks and blocks, properties, tests, relevant BIS codes, timber: structure of wood, defects in timber, Types of boards, plywood and its manufacturing, paints & varnishes, gypsum, tar, bitumen & asphalt, Nanomaterials, smart materials, composite materials, geo-synthetics, heat & sound insulating materials.

UNIT-V:

Study of Earth's internal structure: crust, mantle and core of the earth, Rock: mode of formation and classification, Physical and engineering properties of Igneous rocks, Rock as engineering material, relevance of igneous, sedimentary and metamorphic rock in civil engineering, Tectonic activity, fold, faults, joints and unconformities.

Textbooks:

1. Engineering Materials by S.C. Rangwala
2. Properties of concrete by A M Neville
3. Geology for Engineers by Dr. D.S. Arora

Reference Books:

1. Engineering Materials by R K Rajput.
2. Concrete Technology by M L Gambhir
3. Geology and Engineering, by Legeet, McGraw Hill Book Company, 1998.

GEOMATICS (PCC)

CEC-304

L:3 T:0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand different techniques of distance and direction measurements for determination of horizontal control points for mapping.
2. learn and apply techniques of levelling for determination of elevation of points.
3. prepare topographical maps and apply different methods to compute area and volume for design of civil engineering projects.
4. use total station for mapping and to obtain surveying data for design of civil engineering projects.
5. implement methods of setting out for horizontal and vertical curves.

SYLLABUS

UNIT-I:

Concept of plane and geodetic surveying, classification of surveying, basic principles, measurement of horizontal distance by conventional methods, sources of errors; map scale, measurement of horizontal and vertical angles, traversing and triangulation surveying

UNIT-II:

Concept and principle of levelling, instruments for levelling, types of spirit levelling, methods of booking and reduction of levels, errors in levelling; trigonometrical levelling

UNIT-III:
Topographical surveying, concept and characteristics of contours, methods and uses of contours. Computation of area by different methods, estimation of volume of earthwork

UNIT-IV:

Basics of EDM; applications of total station; setting out of building and tunnel; reconnaissance, preliminary and detailed survey for canals, highways, railways, sewer lines

UNIT-V:

Elements and geometry of horizontal curve, setting out of simple curve by linear and angular methods, and vertical curve

Textbooks:

1. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf. 14th Edition, Prentice Hall, 2014.
2. Surveying and Leveling, T. P. Kanetkar and S.V.Kulkarni Vol.1 & 2, VidhyarthiGriha, Prakashan, Pune, 2008.
3. Surveying B. C Punmia, Ashok K Jain, and Arun K Jain, Vol 1, 2, Laxmi Publications, 2016.

Reference Books:

1. Plane and Geodetic Surveying for Engineers, David Clark and Jackson J. E., CBS Publications and distributors, New Delhi.
2. Elementary Surveying, An Introduction to Geometrics, Charls D. Ghilani and Paul R Wolf, Pearson Publication, 2003.

SEMESTER-IV									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEC-401	**Structural Analysis I**	Theory	PCC	3	3	0	0	3
2	CEC-402	**Hydraulics**	Theory	PCC	3	3	0	0	3
3	CEC-403	**Building Construction and Quantity Surveying**	Theory	PCC	3	3	0	0	3
4	AST-401	Operations Research	Theory	HSMC (OEC I)	3	3	0	0	3
5	AST-402	Economics	Theory	HSMC (OEC II)	3	3	0	0	3
i	CEL-401	**Structural Analysis Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-402	**Hydraulics Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-403	**Civil Engineering Drawing & CAD Lab**	Lab	PCC	1	0	0	2	2
iv	ASL-401	Numeric and Scientific Computing Lab.	Lab	ESC	2	0	0	4	4
				Total	**20**	15	0	10	25

SEMESTER-IV

STRUCTURAL ANALYSIS I (PCC)

CEC-401

L: 2 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. estimate the loads and analyze different types of structures
2. determine the displacements in beams and frames.
3. apply energy methods for the determination of slope and deflection in determinate structures.
4. determine deflection in determinate plane trusses.
5. plot influence lines for beams, trusses, three-hinged arches and their analysis.

SYLLABUS

UNIT-I:

beams, trusses, arches, cables, industrial frames, multistory building frames, shell structure etc.; Loads: DL, imposed loads (LL, WL, seismic load, snow load, erection load etc.), static load, quasi-static load, gradually applied load, suddenly applied load, Impact load,; Idealization of structures; types of supports; stability and static determinacy & indeterminacy of beams & frames; free body diagram; Linear Elastic Analysis: Principle of superposition; Arches:3-hinged parabolic & circular arches, thrust, radial shear and bending moment diagram, spandrel braced arches,

UNIT-II:

Double Integration method, Moment area method, Conjugate beam method and their applications on statically determinate beams and frames; Flexural stiffness of beam with far end pinned & fixed, carry over factor, propped cantilever beam, fixed beam,

UNIT-III:

Strain energy in members: axial loaded members, under bending, under shearing, circular members under torsion; Law of conservation of energy: Real work, virtual work, virtual work on rigid body, virtual work on elastic body; Castigliano's theorems and its application to brackets, lamp posts & curved members, Betti's law of reciprocal work and Maxwell's law of reciprocal deflection, Application of energy methods in beams and frames: Method of virtual work, UNIT load method; Deflection of truss due to temperature variation; fabrication error (Lack of fit) and camber.

UNIT-IV:

Influence Line for Statically determinate structures: Influence Lines, Influence Lines for Beams, Qualitative Influence Lines, and Influence Lines for trusses and three-hinged arches, Use of influence line for analysis of determinate structures

UNIT- V:

Three Moment Equation and Its Application to the Analysis of Continuous Beams; Slope Deflection Method and Its Application to the Analysis of Indeterminate Beams and Frames, Yielding of Supports, Sway Problems. Moment distribution method: Member stiffness factor, joint stiffness factor, carry over factor, distribution factor, procedure for analysis, application to continuous beams and frames with and without sway, symmetrical and unsymmetrical frames

Textbooks:

1. Structural Analysis, by R. C. Hibbeler, Pearsons

Reference Books:

1. Structural Analysis by C. S. Reddy, Tata McGraw Hill
2. Intermediate Structural Analysis by C. K. Wang, Tata McGraw Hill
3. Structural Analysis, by T.S., Thandavamoorthy, Oxford Higher Education

HYDRAULICS (PCC)

CEC-402

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. apply concepts of similitude to model investigation
2. analyze laminar flow through circular pipes and concept of Boundary layer.
3. analyze turbulent flow through circular pipes.
4. analyze pipe flow problems pipe network.
5. analyze performance characteristics of turbine and pumps.

SYLLABUS

UNIT-I:

Dimensional and Model Analysis: Dimensional analysis and its utility; Buckingham's pi-theorem and Raleigh's method and their application to fluid flow problems; Dimensionless parameter in fluid flow and their relevance; Similarities: Application of dynamic similarity to model investigations, scale ratio for distorted model.

UNIT-II:

Laminar flow: Flow through circular pipes, flow through parallel plates, power absorbed in viscous flow, concept of friction factor, Reynolds's number and its significance; Boundary Layer: Boundary layer along a thin plate and its characteristics, laminar and turbulent boundary layer, laminar sub- layer; Displacement, energy and momentum thickness, separation of boundary layer and its control, drag and lift.

UNIT-III:

Turbulent Flow: Nature of turbulent flow and its origin, Reynolds's stress, Prandtl's mixing length hypothesis; Momentum integral equation; Hydro dynamically smooth and rough boundaries, Velocity distribution for turbulent flow in smooth and rough pipes; Friction factor in smooth and rough pipes, Moody's diagram, and Colebrook's equation.

UNIT-IV:

Pipe flow: Hazen William & Darcy Weisbach equation, minor and major losses, Pipes in series and parallel; Concept of equivalent length, Dupuits equation, two reservoir problem, pipe network, Hardy cross method, Time of emptying a reservoir through a weir, power transmission through pipes, water hammer, air vessels.

UNIT-V:

Turbine: General layout of hydroelectric power plant and classification, impulse and reaction turbines, efficiency of turbines, classification based on discharge, head and specific speed, UNIT power and UNIT discharge.

Pumps: Reciprocating Pumps, working principal of both double and single reciprocating pump, indicator diagram frictional loss, centrifugal pump, their advantages over reciprocating pump, classification of centrifugal pump, operation of centrifugal pump in series and parallel.

Textbooks/Reference Books:

1. Robert L Daugherty, Fluid Mechanics with Engineering Applications, McGraw-Hill,
2. John F. Doughlas, Janusz M. Gasiorek, John A. Swaffield, and Lynne B. Jack. Fluid Mechanics, Pearson, 2012
3. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, Fundamentals of Fluid Mechanics, 5th Edition, John Wiley and Sons, 2006
4. Modi, P. N. and Seth, S. M. Hydraulics and Fluid Mechanics, Standard Publishing House, Delhi, 2009
5. A.K. Jain Fluid Mechanics, Standard Publishing House, Delhi.

BUILDINGS CONSTRUCTION AND QUANTITY SURVEYING (PCC)

CEC-403

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand various types of building and foundation.
2. identify the requirements of various elements of the buildings.
3. understand the provision for waterproofing, fire protection, daylighting, thermal and sound insulation techniques.
4. estimate the quantities of items using different methods.
5. estimate the rate of various items and calculate the productivity of labor and machines.

SYLLABUS

UNIT-I:

Classification of buildings: Basics as per National Building Code- Part-II, their requirements, Types of Constructions: Load bearing structure, framed structure, composite structure, Foundation: types and requirements, stairs and escalators: Location, types and requirements.

UNIT-II:

Stone Masonry and Brick Masonry, Different terms used in Masonry, Bond and its types, Composite Masonry, Panel Walls, Load Bearing Walls, Compound Walls, Cavity Walls, Partition Walls, Flooring: Different types of Flooring, Roof: Flat roof, sloped roof, Types of Sloped Roof, Arches: Different types of arches.

UNIT-III:

Water proofing and Damp proofing: Necessity and importance, Materials, methods; Fire protection as per NBC; Daylighting, Thermal, and sound insulation in buildings; Ventilation design in buildings

UNIT-IV:

Types of estimates, Preliminary estimates of building by given plinth area, floor area and covered area, various forms used in estimating, estimation of two room building by long wall, short wall and centre line method, degree of accuracy in estimating.

UNIT-V:

Analysis of rates, purpose of rate analysis, factors affecting rate analysis of concrete work, brick work, and plastering; Valuation in construction; Productivity of labour and machines, safety management in civil engineering.

Textbooks:

1. Equipment and Methods, Indian Edition, Mc-Graw Hill-Education, New Delhi
2. Estimating and costing by B N Datta, S S Dutta and Co.
3. Building construction by B. C. Punmia.

Reference Books:

1. Kumar NeerajJha, (2015), Construction Project Management, 2nd Edition, Pearson, New Delhi.
2. Analysis of rates, CPWD
3. National Building code of India (2005).
4. Manual of Tropical Housing and Building, O H Koenisberger.

OPERATIONS RESEARCH (HSMC)

AST-401

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. identify and develop operational research models from the verbal description of the real system.
2. understand the mathematical tools that are needed to solve Linear programming problem, transportation problem, and assignment problems.
3. understand the basic concepts of goal programming and queuing theory for different applications.
4. use mathematical tools/software to solve the simulation models.
5. understand network development and project management technique.

SYLLABUS

UNIT-I:

Nature and development of operations research, OR general methodology, applications of OR to industrial problems. Formulation of linear programming; deterministic models Linear Optimization Models: Graphical solutions. Simplex algorithm, computational procedure in simplex, duality and its concept, elementary sensitivity analysis, Application of Linear Programming. Application of LINDO, LINGO and related software for solving optimisation problems.

UNIT-II:

Integer Programming: Relationship to linear programming (LP), Formulating IP models, Solving IP Problems: Branch-and-Bound, Cutting Plane Method. Transportation problems; methods for obtaining the solution, degeneracy in transportation problems. Stepping stone method. Trans-shipment problems. Assignment problems.

UNIT-III:

Goal Programming (GP): Definition and purpose of GP, Comparison with other optimization techniques (LP, IP), Formulation and Solution Techniques of Goal Programming Models, Queuing Problems: Queuing systems and concepts; classification of queuing situations; Kendall's notation, solution of queuing problems, single channel, single stage, finite and infinite queues with Poisson arrival and exponential service time; applications to industrial problems.

UNIT-IV:

Simulation: Introduction, reasons for using simulation, limitations of simulation. Steps in simulation process. Application of simulation. Computer simulation. Monte Carlo simulation. Sequencing, n jobs two stations, two jobs n stations and graphical method. Decision theory.

UNIT-V:

Network development, Gantt chart. Project Critical path scheduling, construction of a CPM network, the critical path. Float calculations. Project Evaluation and Review Technique and its calculations, Network applications in operations management. Project crashing and resource allocation. Newer Network methods.

Textbooks:

1. Operations Research – Introduction, Taha, H.A., Pearson Education, India

Reference Books:

1. Quantitative Techniques for Decision Making, Gupta M P, Prentice Hall of India.
2. Introduction to Operations Research by Hillier and Lieberman, Tata McGraw Hill, India

ECONOMICS (HSMC)

AST-402

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. interpret the significance of engineering economy, demand and supply, and market structure.
2. apply the basic principles of the time value of money and its application to draw the cash-flow diagrams (CFD) and to compute equivalent values for time-based cash flows of varying complexities.
3. select and apply different standard methods for economic studies.
4. evaluate different alternatives using the economic study methods to design the best one for considered application.
5. suggest, customize and implement the most suitable forecasting, depreciation, depletion and depreciation methods.

SYLLABUS

UNIT-I:

Introduction to engineering economy: Definition, the economic environment, methodology and application, Principles of engineering economy, Steps in engineering economic analysis, Cost concepts and its application to break-even analysis, Basics of demand, supply and equilibrium, Price elasticity of demand, Income elasticity of demand, Cross elasticity of demand, Market structure: Perfect competition, Monopoly, Monopolistic competition and Oligopoly.

UNIT-II:

Interest and money-time relationship: Simple and compound interest, notation and cash flow diagram, the concept of equivalence. Interests formulas for discrete compounding and discrete cash flows relating present and future worth of single cash flows and uniform time series (annuity), deferred annuities, annuities with beginning of period cash flows, equivalent present worth, future worth and annual worth, Interest formulas relating an arithmetic gradient series to its present and annual worth, Nominal and effective interest rates, interest problems with uniform cash flows occurring less often and more often than compounding periods, Increasing and decreasing gradients.

UNIT-III:

Basic methods of making economic studies: Present worth (P.W. method, annual worth (A.W.) method, future worth (F.W.) method, internal rate of return (I.R.R.) method, external rate of return (E.R.R.) method, explicit reinvestment rate of return (E.R.R.R.) method

UNIT-IV:

Selection among alternatives: alternatives having identical (or not known) revenues and lives, Alternatives having identical revenues and different lives, Selection among independent alternatives.

UNIT-V:

Demand estimation and forecasting: Basic categories of forecasting method, Extrapolative methods, simple average, moving average and exponential smoothing, Errors involved in forecast. Explanatory methods, regression analysis for linear forecaster, coefficient of determination and correlation. Qualitative method, Delphi approach, Market survey, Depreciation and depletion: Definition and purpose, types of depreciation, and depreciation methods.

Textbooks:

1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad Noor Siddiquee, Brajesh Kumar, Mustufa H. Abidi. Cambridge University Press, New Delhi, India.

Reference Books:

1. Engineering Economy, Degarmo E. Paul, Sullivan William G. And Bontadelli James A. Macmillan Co. of Singapore.
2. Engineering Economy, Leyland Blank T. and Tarquin Anthony J. (1989), McGraw Hill Publishing Company Ltd., India.
3. Engineering Economy, Panneerselvam R. Prentice Hall of India. Modern Production/Operations Management, Elwood S. Buffa and Rakesh K. Sarin, Wiley India Pvt. Ltd.

SEMESTER-V									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEC-501	**Soil Mechanics**	Theory	PCC	3	3	0	0	3
2	CEC-502	**Water Treatment & Supply**	Theory	PCC	3	3	0	0	3
3	CEC-503	**Design of RCC Structures**	Theory	PCC	3	3	0	0	3
4	CEC-504	**Structural Analysis II**	Theory	PCC	3	3	0	0	3
5	CEC-505	**Design of Steel Structures**	Theory	PCC	3	3	0	0	3
6	CEE-50x	***CEE-501 Open Channel Flow/ Other PEC through SWAYAM (one PEC to be opted by students)***	Theory	PEC	3	3	0	0	3
i	CEL-501	**Soil Mechanics Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-502	**Water Treatment Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-503	**RCC Design & Drawing Lab**	Lab	PCC	1	0	0	2	2
iv	CEL-506	**Surveying Camp**	Lab	PCC	1	0	0	2	2
				Total	**22**	18	0	8	26

SEMESTER-V

SOIL MECHANICS (PCC)

CEC-501

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand the concept of soil classification.
2. solve problems of flow through soils.
3. compute vertical stresses in the soil.
4. interpret compaction and consolidation characteristics of different soils.
5. evaluate shear strength and bearing capacity of soils.

SYLLABUS

UNIT-I:

Type of soils, soil structure, and clay mineralogy, three phase system and phase relationships, Classification: unified and is classification system, index properties.

UNIT-II:

Permeability, factors affecting and its determination, permeability of stratified soil deposits, one dimensional flow, Darcy's law, seepage through soils: two-dimensional flow, flow nets, uplift pressure, piping.

UNIT-III:

Total, neutral and effective stresses, capillarity, seepage force, quicksand condition. stress distribution under applied loads: Boussinesq's equation and Newmark's chart, pressure bulbs.

UNIT-IV:

Compaction: lab and field compaction, proctor compaction tests, field control of compaction; compressibility, Terzaghi's one dimensional consolidation and its time rate.

UNIT-V:

Mohr-Coulomb strength criteria, direct and triaxial shear tests, vane shear test, unconfined compression test, drainage conditions, stress-strain characteristics of clays and sand, stress paths, bearing capacity of soils.

Textbooks / Reference Books:

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers, 7th edition, Reprint 2022
2. Soil Mechanics and Foundation by Punmia, Jain and Jain; Laxmi Publications (P) Ltd.
3. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors Pvt. Ltd.

WATER TREATMENT AND SUPPLY (PCC)

CEC-502

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. evaluate important parameters required for design of water supply systems
2. analyze and design different components of water supply systems
3. analyze important water quality parameters and develop a water treatment scheme accordingly
4. apply basic principles and design philosophies in design of treatment operations and processes
5. analyse and design of advanced water treatment systems

SYLLABUS

UNIT-I:

Water demand, types of demands, factors affecting per capita demand, variations in demand. Population forecasting. Water supply systems and their components. Sources of water supply, factors governing the selection of source. Intakes, types of intakes, factors governing the location of intake, design of intake structure.

UNIT-II:

Storage reservoirs, types of reservoirs, determination of reservoir capacity. Water distribution system, requirements of a good distribution system, methods of distribution, layout, and design of water supply systems. Pipes, types of pipes for transporting water, joints in pipes, testing of pipelines, pipe appurtenances. Pumps, types of pumps, head power and efficiency of pumps, economical diameter of pumping mains. Introduction to Building water supply system. Introduction to related software.

UNIT-III:

Physical chemical and microbiological water quality parameters, their significance, water borne diseases and their control, drinking water quality criteria and standards. Natural processes occurring for self-cleansing of water bodies. Engineered systems of water treatment, different components of water treatment plants. Aeration, mechanics of gas transfer, types of aerators, applications of aeration.

UNIT-IV:

Sedimentation, theory of sedimentation, design of sedimentation tank, types of sedimentation tanks. Coagulation, theory of coagulation, types of coagulants and coagulant aids, and flocculation, design of flocculation tank.

UNIT-V:

Water softening- chemical precipitation, ion exchange. Filtration, theory of filtration, types of filters and their classification, filter operations. Disinfection, types of disinfectants, characteristics of good disinfectant, different methods of disinfection. Advanced methods of water treatment – GAC, ultrafiltration, reverse osmosis. Site selection for treatment plant, layout considerations for treatment plant, introduction to automation of water treatment plants.

Textbooks:

1. Santosh Kumar Garg, Water Supply Engineering, Khanna Publishers, New Delhi 2018
2. PN Modi, Water Supply Engineering (Environmental Engineering – I), Standard Book House, New Delhi 2018
3. Peavy Howard S, Rowe Donald R, Tchobanglous Geroge, Environmental Engineering, McGraw Hill Education (India) Pvt Ltd 2013

Reference Books:

1. CPHEEO, Manual on Water Supply and Treatment, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, Government of India.
2. Davis Machenzie L, Water and Wastewater Engineering – Design Principles and Practice, McGraw Hill Education (India) Pvt Ltd 2014
3. Gray NF, Water Technology – An Introduction for Environmental Scientists and Engineers, Elsevier, 2nd Ed.
4. Qasim Syed R, Motely Edward M, Zhu Guang, Water Supply Engineering, Prentic Hall of India 2006
5. Sincero Arcadio P, Sincero Gregoria A, Environmental Engineering – A Design Approach, Prentice Hall of India 2010
6. Walter J, Weber Jr, Physicochemical Processes for Water Quality Control, John Wiley & Sons, 1972

DESIGN OF RCC STRUCTURES (PCC)

CEC-503

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand design philosophies and design of beams using working stress method
2. design beams using limit state method
3. develop understanding of bond, development length and would be able to design for shear and torsion.
4. gain knowledge about Indian standards, use of design charts & table for design of beams and slabs.

SYLLABUS

UNIT-I:

Characteristic strength, stress-strain relationship for concrete and steel, IS specifications (IS 456, 875 & 1893), characteristic imposed loads, DL, EL & WL. Design philosophies - Working stress method and limit state method. Strength and serviceability requirements, Analysis, and design for flexure of singly / doubly rectangular and flanged beam sections - by working stress method.

UNIT-II:

Analysis and design for flexure of singly / doubly rectangular and flanged beam sections - by limit state method. Serviceability limit states for deflection and cracking; Codal provisions for maximum/minimum reinforcement and spacing of bars, requirements for curtailments and detailing of reinforcement; Introduction and use of design aid (SP-16), calculation of deflection.

UNIT-III:

Bond stress: flexural & anchorage bond stress, design bond stress, development length, anchorage length; Behaviour of beams in shear, design for shear & torsion as per limit state method; Reinforcement detailing.

UNIT-IV:

Complete design of a cantilever and simply supported beam with and without overhang; Design of continuous beams with Rectangular, T & L sections; Introduction to slabs: rectangular slab, one way simply supported & continuous slab and their design, Design of an isolated column with footing; Comparison of manual design with the software available.

Textbooks:

1. R. C. C. Design by Pillai and Menon, Tata McGraw Hill
2. Reinforced Concrete Design by S. N. Sinha, Tata McGraw Hill
3. Limit State Design by P, C. Verghese, Prentice Hall
4. Reinforced Concrete Limit State Design, Ashok K Jain Nemchand & Bros, Roorkee

Reference books:

1. Structural Analysis by Norris, Wilbur
2. Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi, IS456-2000.
3. Design Aids for Reinforced Concrete to IS 456, Special Publication (SP16), BIS New Delhi, 1980.

STRUCTURAL ANALYSIS-II (PCC)

CEC-504

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. perform plastic analysis of beams and frames, understanding shape factors and theorems of plastic analysis.
2. analyse cables subjected to various loads, suspension bridges with stiffening girders, and understand the application of Muller Breslau principle for influence line diagrams.
3. apply approximate methods for the analysis of building frames
4. utilize the force/flexibility/compatibility/consistent deformation methods to analyse beams.
5. develop stiffness and displacement matrices and apply the stiffness method to analyse pin-jointed plane trusses.

SYLLABUS

UNIT-I:

Introduction to plastic analysis, shape factor, theorems of plastic analysis, bending of beams symmetrical about both axes, fundamental conditions for plastic analysis, rigid plastic analysis, analysis of beams and frames.

UNIT-II:

Analysis of cables subjected to concentrated load and UDL; analysis of suspension bridges with stiffening girder; Influence Line Diagram (ILD): Muller Breslau principle and its application.

UNIT-III:

Use of approximate methods; approximate analysis of statically indeterminate structures under vertical loads; lateral loads on building frames: Cantilever Method and Portal Method.

UNIT-IV:

Force/Flexibility/Compatibility/Consistent Deformation Method of analysis; compatibility and equilibrium; flexibility coefficients; flexibility matrices; beam analysis using Flexibility Method.

UNIT-V:

Fundamentals of the Stiffness Method; member stiffness matrix; displacement and force transformation matrices; member global stiffness matrix; truss stiffness matrix; application of the Stiffness Method for truss analysis; beam-member stiffness matrix; beam-structure stiffness matrix; truss analysis using Stiffness Method.

Textbooks:

1. Structural Analysis by R. C. Hibbeler, Pearson
2. Structural Analysis by Weaver and Gere, Cengage Learning
3. Intermediate Structural Analysis by C. K. Wang, Tata McGraw-Hill
4. Structural Analysis by Aslam Kassimali, Cengage Learning

Reference Books:

1. Structural Analysis by Norris & Wilbur, McGraw-Hill
2. Basic Structural Analysis by C. S. Reddy, Tata McGraw-Hill
3. Examples in Structural Analysis by William M. C. McKenzie, Taylor & Francis

DESIGN OF STEEL STRUCTURES (PCC)

CEC-505

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. analyse and design of bolted and welded connections.
2. analyse and design of tension members with different failure criteria
3. analyse and design of columns/built up columns with various configurations and end conditions.
4. analyse and design of laterally supported and unsupported beams.

SYLLABUS

UNIT-I:

Common steel structure, advantages and disadvantages of steel structures, types of steel, rolled steel sections, special considerations in steel design, design philosophy, limit state design, design strength, deflection and serviceability limits, stability checks.

Riveted, bolted and welded connections, classification of bolts and types of bolted connections, IS 800-2007 specifications for design of bolted connections, worked examples on design of bolted joint, shear capacity, prying forces and tension resistance of bolts (IS-1364), design examples of fillet and butt weld connections, design of eccentric bolted and welded connections.

UNIT-II:

Design strength of tension member due to yielding of gross section, rupture strength of critical section and block shear, tension splices and lug angles; design of bolted and welded connections for ties subjected to both bending and axial tension.

UNIT-III:

Buckling class of cross-section, slenderness ratio, design compressive stresses and strengths, use of IS800-2007 tables for design stresses, design of compression members, design of laced and battened columns, design of column splices; Column bases: design of slab base and gusseted base.

UNIT-IV:

Behaviour of beam in flexure, section classification, plastic moment carrying capacity of a section, bending and shear strengths of laterally supported beams, design of laterally supported beams, deflection limits, web buckling and web crippling, design of built-up beams, design strength of laterally unsupported beams, effective lengths for lateral torsional buckling, design of laterally unsupported beams.

Textbooks:

1. Limit State Design of Steel Structures, SK Duggal, Tata Mac-Graw-Hill Publication-2010.
2. Limit-State-Design of Steel Structures by N. Subramanium, Oxford University Press-2009
3. Design of steel structures by B C Punmia.

References:

1. IS 456-2000: Code of practice for plain and R. C. BIS, New Delhi.
2. I.S.800:2007, Code for general construction in steel structures, Bureau of Indian Standards, Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi.
3. I.S.875 (part I to part V), Code of Practice for. Design Loads, Bureau of Indian Standards, Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi.
4. I.S.226, Steel for general structural purposes, Bureau of Indian Standards, Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi.

5. I.S.808:1989, Code for Classification of Hot Rolled Steel, Bureau of Indian Standards, ManakBhavan, 9, Bahadur Shah Zafar Marg, New Delhi.
6. I.S.1364, Steel bolts and connection, Bureau of Indian Standards, Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi.
7. I.S.808:1989, Code for Classification of Hot Rolled Steel, Bureau of Indian Standards, Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi.
8. I.S.816:1969, Code of practice for use of metal are welding for general construction in mild steel, Bureau of Indian Standards, Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi

OPEN CHANNEL FLOW (PEC)

CEE-501

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand geometrical properties of channel sections of different shape
2. apply the concept of specific energy in the analysis of channel transitions
3. understand and analyze flow profiles on different sloped channels
4. analyze rapidly flow problems with focus on practical applications to real-world problems
5. understand the importance of devices used in the measurement of flow through channels.

SYLLABUS

UNIT-I:

classification of open channel flow. Geometric properties of channel section, Velocity and Pressure distribution in Channel Flow, Kinetic energy and momentum correction factors. Uniform flow, Application of Manning's and Chezy's formulae.

UNIT-II:

Critical flow, Specific Energy and Force. Transitions in channels, channel with a hump, transition with change in width, choking flow. Channel conveyance, section factor for critical flow and uniform flow computations. Most economical section of a channel.

UNIT-III:

Gradually varied flow equation, assumptions and different forms of the equation, characteristics and classification of flow profiles. Analysis of flow profiles on mild, steep, horizontal, and adverse slopes. Solution of the gradually varied flow equation, Graphical integration method, Direct step method and standard step method.

UNIT-IV:

Hydraulic Jump, its definition and types. Momentum equation for the jump, Characteristics of jump in horizontal rectangular channel, Computation of energy loss and length, location of jump, and pressure distribution. Energy dissipaters

UNIT-V:

Flow in channels with sharp & broad crested weir. Flow measurement with non-rectangular weirs; Triangular, circular and parabolic weir. Discharge using linear proportional weir, Sutro weirs, Quadratic weir, Ogee spillway and sluice gate.

Textbook:

1. Open channel flow by V.T Chow. McGraw Hill.

Reference Books:

1. Flow in Open channels by K Subramanya. Tata McGraw- Hill.
2. Flow in Open channels by Ranga Raju. Tata McGraw- Hill.

SEMESTER-VI									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEC-601	**Engineering Economics & Construction Management**	Theory	PCC	3	3	0	0	3
2	CEC-602	**Wastewater collection and Treatment**	Theory	PCC	3	3	0	0	3
3	CEC-603	**Transportation Engineering**	Theory	PCC	3	3	0	0	3
4	CEC-604	**Engineering Hydrology**	Theory	PCC	3	3	0	0	3
5	CEE-60x	***CEE-601 Advanced Structural Design I / other PEC through SWAYAM (one PEC to be opted by students)***	Theory	PEC	3	3	0	0	3
i	CEL-601	**Construction Management Lab**	Lab	PCC	1	0	0	2	2
ii	CEL-602	**Wastewater Engineering Lab**	Lab	PCC	1	0	0	2	2
iii	CEL-603	**Transportation Engineering Lab**	Lab	PCC	1	0	0	2	2
iv	CEL-605	**Civil Engineering Software Lab**	Lab	PCC	1	0	0	2	2
v	CEP-601	**Seminar**		PROJ	1	0	0	2	2
				Total	**20**	15	0	10	25

SEMESTER-VI

ENGINEERING ECONOMICS & CONSTRUCTION MANAGEMENT (PCC)

CEC-601

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. carry out economic evaluation and risk of civil engineering projects.
2. implement work breakdown structure and planning of a project using productivity data.
3. apply PDM and other techniques in construction planning.
4. apply project monitoring and control techniques in construction planning.
5. plan and organize construction site and resources.

SYLLABUS

UNIT-I:

Benefit/Cost Analysis and Public Sector Economics, Sensitivity Analysis and Staged Decisions, Decision Making under Risk.

UNIT-II:

Definition of Project, tendering & contracts. Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work breakdown structure, activity lists, concept of productivities, estimating durations, sequence of activities.

UNIT-III:

Construction planning: precedence network, Ladder network, the line of balance, network technique advantages, Project scheduling and resource levelling, Computer applications in scheduling and resource levelling.

UNIT-IV:

Project monitoring and control system: updating, cost control, earned value method. Computer applications in monitoring and reporting.

UNIT-V:

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site, Manpower: planning, organizing, staffing, motivation; Materials: basic concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing.

Textbooks:

1. Construction Project Management, Theory and Practice by Kumar Neeraj Jha, Pearson Education, New Delhi. Years?
2. Scheduling Construction Projects by Sanra Christian Weber, Pearson Education, New Delhi.

Reference Books:

1. Peter Fewings, “Construction Project Management”, Taylor and Francis, U.K.
2. Peurifoy, R.L., Ledbetter, W. B. and Schexnayder, C., "Construction Planning, Equipment and Methods ", 5th Edition, McGraw Hill, Singapore, 1995.
3. Sharma S.C. “Construction Equipment and Management ", Khanna Publishers New Delhi, 1988.
4. Deodhar, S.V. “Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 1988.
5. Dr. Mahesh Varma, “Construction Equipment and its Planning and Application “, Metropolitan Book Company, New Delhi-,1983.

6. Prasanna Chandra, “Project-Planning Analysis Selection Implementation & Review Fourth Edition”, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi., 1995.
7. Joy P.K., "Total Project Management - The Indian Context (Chapters 3- 7)", New Delhi, Macmillan India Ltd., 1992.
8. United Nations Industrial Development Organization (UNIDO) "Manual for the preparation of Industrial Feasibility Studies “, (IDBI Reproduction) Bombay, 1987.

WASTEWATER COLLECTION AND TREATMENT (PCC)

CEC-602

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand of estimation of sewage generation & its flows and design of sewers
2. understand the importance of sewage treatment & it's safe disposal
3. understand the kinetics of sewage treatment and design of preliminary and primary UNITs
4. design various aerobic and anaerobic processes of sewage treatment
5. understand modern methods of sewage treatment and sludge management

SYLLABUS

UNIT-I:

Different sources of sewage generation: domestic, industrial and storm water; types of sewerage and drainage system; Estimation of stormwater and wastewater flow rates and its variations: Estimation of peak, average and lean flow; Hydraulics of sewers and sewer appurtenances; Design of wastewater collection systems; Design of storm water drains. Introduction to relevant software.

UNIT-II:

Physical, chemical, and biological characterization of wastewater, effluent discharge standards; Solids: Suspended, dissolved and volatile solids; Organics: BOD and its concepts - CBOD and NBOD, COD, ThOD, TOC, Total and Kjeldahl nitrogen, Phosphate; Effect of wastewater discharge on surface water: Response of streams to biodegradable organics, dissolved oxygen balance and its modelling, factor affecting steam flow rejuvenation; Sources of microbes and pathogens in wastewater: Concept of indicator organism

UNIT-III:

Primary, secondary, and tertiary treatment; types of screens and its design, assessment of head loss through screen, classification of grit chambers, its application and design, oil and grease removal; Design of primary and secondary clarifiers; Overview of bacterial growth and decay in pure and mixed cultures, Monod's equation, Fundamental concept of reactors: Batch reactors, completely mixed flow reactors and plug flow reactors; Suspended and attached growth systems

UNIT-IV:

Aerobic Treatment: Activated Sludge Process and its modifications, Trickling Filter/Bio Towers and Rotating Biological contractor; Anaerobic Treatment: Up-flow Anaerobic Sludge Blanket Process

UNIT-V:

Modern methods of sewage treatment; Methods of sludge disposal, sludge dewatering, thickening, and its digestion, sludge management; Low-cost sanitation: stabilization ponds, aerated lagoons, oxidation ditch; Reuse of treated effluents; Concepts of zero discharge

Textbooks / Manuals / Reference Books:

1. Environmental Engineering, Peavy, Rowe & Tchobanoglobus, McGraw Hill
2. Introduction to Environmental Engineering, Davis & Cornwell, McGraw Hill
3. Wastewater Engineering Treatment & Reuse, Metcalf & Eddy, McGraw Hill, USA
4. Environmental Engineering- A design Approach, Sincero & Sincero, Prentice Hall of India
5. Wastewater Treatment Plants: Planning, Designing and Operation, S.R. Qasim, CRC Press, USA
7. Wastewater Treatment for Pollution Control and Reuse, Soli J. Arceivala & Asolekar, Tata McGraw Hill,
8. Post Treatment of Anaerobically Treated Effluents, V. K. Tyagi, Abid Ali Khan, Anwar Khursheed, A.A. Kazmi, Ng Wun Jern, IWA Publishing, UK
9. Manual of Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi.

TRANSPORTATION ENGINEERING (PCC)

CEC-603

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. gain knowledge on highway planning, project preparation and geometric design of roads.
2. learn basic concepts of highway geometrics and geometric design.
3. understand basic concepts, analysis and design of traffic flow and traffic facilities.
4. gain knowledge of different highway materials and their characteristics and design flexible pavements.
5. design the rigid pavements and gain knowledge of construction, maintenance and drainage of highways.

SYLLABUS

Unit-I:

Importance of Transportation, Different modes of transportation, Brief history of road development around the world. Twenty-year road development plans, Necessity of highway planning, Road patterns, Preparation of Master Plan and its phasing, Highway alignment, Engineering and other surveys for highway location, Highway projects evaluation.

Unit-II:

Introduction Design speed, Highway cross – section elements, Analysis of sight distances, Design of horizontal and vertical alignments – all pertinent elements, Types of intersection, Principles of intersection design.

Unit-III:

Traffic characteristics, traffic studies – volume, speed, origin and destination, parking and accident studies, Road Safety Audit (RSA), Traffic controls- traffic signs, marking and traffic signals, Highway capacity, Signal design.

Unit-IV:

Subgrade soil, aggregates and bituminous material; different tests on these materials. Bituminous mix design, pavement types, Soil stabilized roads. Pavement design: Introduction, Design parameters, Design of flexible pavement.

Unit-V:

Design of rigid pavement, construction of WBM road, bituminous pavements and cement concrete pavements, Highway maintenance and drainage.

Textbooks:

1. Highway Engineering by Khanna, Justo and Veeraragavan, Nem Chand and Bros, Roorkee, 2017.
2. Principles of Transportation Engineering by Chakroborty and Das, PHI, 2017.
3. Relevant IRC codes

Reference Books:

1. Transportation Engineering and Planning by Papacostas and Prevedouros, PHI, 2001.
2. Pavement analysis and design by Y H Huang, Pearson Prentice Hall.
3. Specifications for roads and bridges by MoRTH (Ministry of Road Transport and Highways, Govt of India, V Revision)

ENGINEERING HYDROLOGY (PCC)

CEC-604

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand various components of hydrological cycle
2. estimate various abstractions from precipitation such as evapotranspiration and infiltration
3. derive relationship between rainfall and runoff using statistical techniques and plot stage discharge relationship
4. derive UNIT hydrographs of different durations, and develop synthetic UNIT hydrographs
5. apply the technique of flood routing for the mitigation of floods in channels

SYLLABUS

UNIT-I:

Precipitation: Hydrologic cycle, World's Water balance, Types and Forms of precipitation. Measurement of precipitation. Adequacy of rain gauges. Average rainfall over an area.

UNIT-II:

Evaporation: Evaporation process, Transpiration, Evapotranspiration, measurement of evapotranspiration-Thornwaite and Blaney Criddle methods. Evaporation Control. Infiltration: Infiltration Process, factors affecting infiltration, measurement of infiltration, infiltration indices

UNIT-III:

Surface Runoff: Factors affecting runoff. Rainfall – runoff relationships, empirical equations. Flow duration Curve. Stream Gauging: Measurement of stage, velocity. Direct and indirect methods of stream flow measurement. Rating curve, Stage discharge relationship.

UNIT-IV:

Hydrograph: Introduction, Base flow separation. UNIT hydrograph. Derivation of UNIT hydrograph for simple and complex storms. UNIT hydrograph of different durations.

UNIT-V:

Flood: Flood flow formulae, Design flood Frequency analysis using external type and log Pearson type III distribution. Flood Routing: Basic equation, Hydrologic storage routing in reservoirs and channels.

Textbooks:

1. Engineering Hydrology by K Subramanya, Tata McGraw- Hill.

Reference Books:

1. Elementary Hydrology by V. P. Singh, Prentice Hall
2. Hydrology for Engineers by Linsely R. k. Tata McGraw- Hill.

ADVANCED STRUCTURAL DESIGN-I (PEC)

CEE-601

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. assess the load criteria and design of RCC slab and staircases.
2. design reinforced concrete short and long columns subjected to uniaxial and bi-axial compression.
3. select the most suitable section shape and size for Plate girder and design according to specific design criteria.
4. analyse and design roof trusses, estimation of wind load and design of gantry girder.

SYLLABUS

UNIT-l:

Various type of slabs and their behaviour, design of two- way rectangular slabs with different boundary conditions, use of moment coefficients, provision for corner reinforcement; Design of stairs.

UNIT-Il:

Columns, various cross sections, effective length, slenderness ratio, short and long columns, design of columns under uni-axial and bi-axial compressions, uses of interaction curves of SP16 for column design.

UNIT-III:

Elements of plate girder, self-weight of plate girder, economical depth, size of flanges, shear buckling resistance of web, end panel design, anchor forces, design of connections between flanges and web plates, design of bearing and intermediate stiffeners and their connections with web; Design of welded plate girders.

UNIT-IV:

Types of roof trusses, loads on trusses: wind load estimation, snow load, live load and load combinations, bracings, spacing of trusses, purlins, sheetings, analysis of trusses, grouping of members, design of members, bolted joints and end bearings, Design loads for Gantry Girders, position of moving load for maximum effect, limitation on vertical deflection, design procedure of gantry girder.

Textbooks:

1. Limit State Design of Steel Structures, SK Duggal. Tata Mac-Graw-Hill Publication-2010.
2. Limit-State-Design of Steel Structures by N. Subramanium-2009, Oxford University Press.
3. Limit State Design of Concrete Structures by Verghees, Vol. 1.

Reference Books:

1. Reinforced Concrete Design, by S U Pillai and Devdas Menon, Tata-McGraw-Hill Publishing Company Limited, New Delhi.
2. Comprehensive Design of RCC Structures, by B C Punmia, A K Jain and A K Jain, Laxmi Publications (P) Ltd, New Delhi
3. Design of Reinforced Concrete Structures, by S Ramamrutham, Dhanpat Rai Publishing Company, New Delhi.
4. Limit State Theory and design of reinforced Concrete, by V L Shah and SR Karve, Structures Publications, Pune, 2011
5. Reinforced Concrete Structures, by Park R and Paulay T, John Wiley & Sons, Inc., New York, 1975.
6. IS 456: 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi.
7. SP16-1978, RCC Design Aids to IS456:1978," Bureau of Indian Standards, Manak Bhavan,9, Bhadur Shah Zafar Marg, New Delhi

SEMESTER-VII									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEE-70x	***CEE-701 Foundation Engineering / other PEC***	Theory	PEC	3	3	0	0	3
2	CEE-70x	***CEE-702 Advanced Structural Design II / other PEC***	Theory	PEC	3	3	0	0	3
3	CEE-70x	***CEE-703 Irrigation Engineering/ other PEC***	Theory	PEC	3	3	0	0	3
4	CEE-70x	***CEE-704 Advanced Transportation Engineering / other PEC/ CEE-705 Building Services/ other PEC***	Theory	PEC	3	3	0	0	3
5	CEO-70x	***CEO-701 Construction Project Management / CEO-702 Computational methods in civil engineering / Other OEC through SWAYAM (one OEC to be opted by students)***	Theory	OEC	3	3	0	0	3
i	CEP-701	Summer Internship	Project-II	PROJ	2	0	0	4	4
ii	CEP-702	Project	Project-III	PROJ	3	0	0	6	6
				Total	**20**	15	0	10	25

SEMESTER-VII

FOUNDATION ENGINEERING (PEC)

CEE-701

L: 3 T: 0 P: 0 Cr: 3

Prerequisite: CE-501

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. analyze earth retaining structures.
2. analyze stability of slopes.
3. interpret soil investigation data.
4. analyze shallow foundation.
5. analyze deep foundation.

SYLLABUS

UNIT-I:

Lateral Earth Pressures: Rankine's and Coulomb's theories, earth pressure on retaining walls, estimation of depth of unsupported vertical cut in Cohesive backfills, Analysis of Sheet pile walls, bulkheads, and anchored sheet pile. Braced Excavations

UNIT-II:

Finite and infinite slopes, types of slope failures, stability analysis of infinite slopes of cohesion less and cohesive soils with Swedish circle and Bishop's methods, stabilization of slopes

UNIT-III:

Purpose extent and methods of site investigation, Boring and sampling techniques, Samplers, boring records, Ground water observations, Plate load test, Penetration tests (standard penetration test, Static & Dynamic Cone penetration tests), pressure meter test

UNIT-IV:

Types of foundations, shallow foundation design criteria; Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundations; Contact pressure, Settlement analysis in sands and clays, evaluation of bearing capacity from field tests, allowable bearing capacity, Settlement analysis, allowable settlement. Proportioning of footing, isolated and combined footings, rafts

UNIT-V:

Pile foundation, types of piles, static and dynamic analysis, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, settlement of piles, negative skin friction, well foundation

Textbooks:

1. Soil Mechanics and Foundations by B C Punmia& Ashok Kumar Jain; Laxmi Publications, Delhi
2. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors Pvt. Ltd.

Reference Books:

1. Basic and applied soil mechanics, Gopal Ranjan and Rao A.S.R., New Age International Publishers
2. Geotechnical Engineering, Venkatramiah, New Age International Publishers
3. Foundation Engineering, Leonards G.A., McGraw Hill 5. Foundation Design, Teng W.C., PHI
4. Problems-in-Soil-Mechanics-and-Foundation-Engineering by Debashis Moitra, Dhanpat Rai Publications.

ADVANCED STRUCTURAL DESIGN-II (PEC)

CEE-702

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. design different types of footings and retaining walls.
2. design different types of water tanks.
3. design different types of bridges and culverts.
4. analyze and design pre-stressed concrete members.

SYLLABUS

UNIT-I:

Detailed design of Isolated and combined footing, design of wall footings. Retaining walls:

Cantilever and Counter fort type, their design using limit state method.

UNIT-II:

Design criteria, material specifications and permissible stresses; IS 3370 (Part-1, Part-2 and Part-4) 2009; Design of circular and rectangular water tanks resting on ground & underground using working stress approach, cracking width in immature concrete and mature concrete in flexure and direct tension.

UNIT-III:

Types of Bridges, Components, IRC loadings, design of deck slab of culvert, Design of T-beam Bridge, introduction to prestress concrete Bridge.

UNIT-IV:

Methods and systems, anchorages, prestress losses, analysis and design of sections for flexure

Textbooks:

1. Pillai S. Unnikrishna and Menon Devdas, Reinforced Concrete Design, McGraw-Hill, 3edition, 2015.
2. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, P. Hall of India Pvt. Ltd.

Reference Books:

1. Lin, T.Y. and Burns H. Ned, Design of Prestressed Concrete Structures, Wiley, 2012
2. Victor D. J. 5th Edition, Essentials of Bridge Engineering, Wiley, 2006
3. Raju N. Krishna, Design of Reinforced Concrete Structures, CBS Publishers and Distributers Pvt Ltd, 4th ed., 2016
4. Sharma N., Reinforced Cement Concrete Design, Katson Books, 2014.

IRRIGATION ENGINEERING (PEC)

CEE-703

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. estimate water requirements of irrigation, irrigation scheduling and capacity of canal.
2. design the canal systems and identify needs of various hydraulic structures including complex ones.
3. analyze subsurface flow, and design weir/barrage on permeable foundation
4. analyze and identify the kind of appropriate canal falls, also find the remedial measures including design of lined canals.
5. plan Cross-Drainage works and their analysis and design.

SYLLABUS

UNIT-I:

Irrigation in India – Necessity, scope of irrigation, irrigation schemes, Irrigation Systems, Engineering aspects of project planning; Soil-water-plant relationship, crop types, water requirements and its estimation, water application techniques and efficiencies. Duty and delta, Fixing the capacity of canal and storages for irrigation purposes. Classification of irrigation canals and canal alignments.

UNIT-II:

Design of Alluvial Channels, Silt theories – problems of silting and scouring, Kennedy's theory and drawbacks, design procedure, Use of Garret's diagram, Lacey's silt theory, channel design procedure, drawbacks, Comparison between Kennedy's and Lacey's theory, Lacey's non-regime equation, L-section of a channel, balancing depth, Cross-section of irrigation channels.

UNIT-III:

Diversion Headworks, Weirs and barrages – components, functions, causes of failure; Bligh's creep theory, Lanes's weighted creep theory, Khosla's theory, pressure calculations, Design of weirs/barrage on permeable foundation.

UNIT-IV:

Water logging – effects of water logging, causes of water logging and their remedial measures. Canal lining – advantages, types of lining, and design of lined channels. Land drainage, design and maintenance of drains Regulation works. Canal falls, types of falls, Design of Sarda type fall. Head regulators and cross regulators

UNIT-V:

Cross-Drainage works, Types of works, factors affecting the suitability of CD works, classifications of aqueducts and siphon aqueducts, Design- maximum flood discharge, water way, transitions, head losses, uplift pressures, Design of a cross drainage works.

Textbooks:

1. Irrigation, Water Resources and Power Engineering by P.N. Modi, Standard Book House, Delhi, Latest edition.
2. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Khanna Publishers, Latest edition

Reference Books:

1. Irrigation and Water Resources Engineering by G.L. Asawa, New Age International Publishers
2. Theory and Design of Irrigation Structures by Varshney and Gupta, Vol. I and II,
3. Hydraulic Structures by Novak, P., AIB Moffat and Nalluri and R Narayanan, Taylor and Francis

ADVANCE TRANSPORTATION ENGINEERING (PEC)

CEE-704

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. build concept in different means of public and private transportation, sustainability and design of public transit network.
2. understand basic concepts, analysis and design of railway track.
3. understand basic concepts, analysis and design of railway track geometrics, stations, yards, signaling and metro railway.
4. analyze and understand airport elements.
5. understand basic concepts of water transportation and bridges.

SYLLABUS

UNIT-I:

Urban transportation problems, Transportation and urban growth, Mass transit system, Comparison of different transit modes, Transit and environment, Transit and urban sustainability, Route design and scheduling of transit system.

UNIT-II:

Introduction of railways, Railway Track, gauge, Track components – Rail, rail fittings, fixtures, Sleepers and ballast requirements and specification per kilometre of track, Formation and cross-section details, drainage, track defects.

UNIT-III:

Geometric design of track, Points and Crossing, Station and Yards, Level crossing, Signalling and control, Suburban Railways, Metro railways system, Modernization of railways, Basics of underground railways and tunnelling.

UNIT-IV:

Aircraft Characteristics, airport planning, site selection and configuration, Obstruction and zoning, Runway and taxiway design, Basic runway length and corrections, geometric design elements, Visual aids – marking and lighting, air traffic control and aids, Airport capacity.

UNIT-V:

Sea Port, Harbors, Types and selection of site, Breakwaters, Jetties, Wharves. Navigation aids: Buoys and light houses, Inland water transportation, Components and classification of bridges, site investigation.

Textbooks:

1. Urban Mass Transportation Planning, A. Black, McGraw Hill.
2. Highway Engineering by Khanna, Justo and Veeraragavan, Nem Chand and Bros, Roorkee.
3. Traffic Engineering and Transport Planning, L. R. Kadiyali. Khanna Publishers
4. Railway Engineering by Chandra and Agarwal, Oxford University Press.
5. Air Transportation Planning and Design by Saxena, CBS Publisher.

Reference Books:

1. Planning and Design of Airports by Horonjeff and McKelvey, McGraw Hill.
2. Specifications for roads and bridges by MoRTH (Ministry of Road Transport and Highways, Govt of India, V Revision).

BUILDING SERVICES

CEE-705

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. design of water supply and plumbing services.
2. design drainage and sanitation systems in buildings.
3. understand concepts of fire protection in buildings.
4. understand elements of HVAC, electrical and lighting services in buildings.
5. understand supplementary service systems such as rainwater harvesting, solar PV and BEMS.

SYLLABUS

UNIT-I:

Water Supply, Hydraulic design, Storage, Design of Distribution systems, Types of pipes Component of cold & hot water supply system.

UNIT-II:

Waste water & Drainage systems: Drainage and sanitation requirements Fixture units and their types, Design of drainage system

UNIT-III:

Fire Protection: Process of combustion in fire, Effect of fire load & ventilation condition on enclosure fire, growth and decay of fire in enclosure, Concepts of fire resistant and severity, Effect of fire on materials. Design of elements for given fire resistance, Site Planning, Internal planning for Escape and refuges, Fire detection & suppression systems, Smoke venting.

UNIT-IV:

HVAC System: Design Consideration. Basic psychometric, Air conditioning process & system. Methods of Air Conditioning. Element of Electrical Services in building, Illumination, Artificial Lighting, & intelligent building systems

UNIT-V:

Elements of lifts systems, escalators, Rainwater harvesting system, Solar PV systems, Building Energy management systems.

Textbooks:

1. Barney G. C. (1986), Elevator technology, John Wiley & Sons,
2. BIS (Bureau of Indian Standards). (2005). National Building code of India, Second Revision, SP-7, Delhi, India
3. Merrit F. S. & Ambrose J. Building Engineering & System Design.
4. BIS (Bureau of Indian Standards). (1987). Handbook of Water supply & drainage, SP-35, Delhi, India
5. Malhotra H. L. (1982) Design of fire resisting structures, Chapman & Hall

Reference books:

1. Egan M. D. (2006) Concept of building fire safety. Krieger Publishing Company
2. Croome D. J. & Roberts B. M. (1980) Air conditioning & Ventilation of building, 2nd edition Oxford: Pergamon Press.

CONSTRUCTION PROJECT MANAGEMENT (PEC)

CEO-701

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand concepts of project management and costing.
2. develop understanding of bidding strategy for the construction projects and resource management.
3. calculate cost of owning and operating construction equipment.
4. understand the use of different types of construction equipment.
5. understand concepts of risk in construction, and Project monitoring.

SYLLABUS

UNIT-I:

Basic concepts of project management, client's estimation of project cost, construction contract.

UNIT-II:

Contractor's estimation of cost and bidding strategy, Gate's and Friedman's model, Construction material management: Procurement process, management functions, inventory management.

UNIT-III:

Construction equipment management: Planning Process of Equipment, Equipment cost - Ownership cost (Average annual investment method), Equipment Cost – Ownership cost (Time Value Method), Equipment Cost -Operating Cost, Equipment Life and Replacement Analysis.

UNIT-IV:

Engineering Fundamentals of Moving Earth, Earth Moving Equipment-Bulldozer, Scrapers, Front End Loaders, Front Shovel, Backhoe, Piles and Pile Driving Equipment, Lifting Equipment – Cranes, Concreting Equipment.

UNIT-V:

Risk management in construction, construction quality management, HSE (Health Safety and Environment). Construction claims disputes and project closure.

Textbooks:

1. Construction Project Management, Theory and Practice by Kumar Neeraj Jha, Pearson Education, New Delhi.
2. Scheduling Construction Projects by Sanra Christian Weber, Pearson Education, New Delhi.

Reference Books:

1. Peter Fewings, "Construction Project Management", Taylor and Francis, U.K.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods ", 5th Edition, McGraw Hill, Singapore, 1995.
3. Sharma S.C. "Construction Equipment and Management ", Khanna Publishers New Delhi, 1988.
4. Deodhar, S.V. "Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 1988.
5. Dr. Mahesh Varma, "Construction Equipment and its Planning and Application ", Metropolitan Book Company, New Delhi-,1983.

6. Prasanna Chandra, " Project-Planning Analysis Selection Implementation & Review Fourth Edition “, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi., 1995.
7. Joy.P.K., " Total Project Management - The Indian Context (Chapters 3- 7) ", New Delhi, Macmillan India Ltd., 1992.
8. United Nations Industrial Development Organization (UNIDO) "Manual for the preparation of Industrial Feasibility Studies “, (IDBI Reproduction) Bombay, 1987.

COMPUTATIONAL METHODS IN CIVIL ENGINEERING

CEO-702

L:3 T:0 P:0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. demonstrate understanding of Python programming.
2. use functions and algorithms to solve computational problems in civil engineering.
3. apply finite difference methods to solve ordinary and partial differential equations.
4. implement finite volume methods in civil engineering problems.
5. use Python programming and computational methods in various civil engineering applications.

SYLLABUS

UNIT-I:

Overview of python programming and its applications in civil engineering, Basic syntax, data types and operators, control structures: conditional statements, Loops: for and while loops, Functions: definition, parameters, and return values.

UNIT-II:

Data structures: nested lists and dictionaries, List and dictionary comprehensions. File handling: reading from and writing to CSV files, reading from and writing to JSON files, Error handling: try, except, and custom exceptions. Introduction to NumPy, pandas and matplotlib for numerical computations.

UNIT-III:

Introduction to numerical methods and finite difference methods, Derivation of finite difference equations, application of ordinary differential equations (ODEs), Application of partial differential equations (PDEs), consistency, stability and convergence analysis, implementation of FDMs in Python, Introduction to FEM

UNIT-IV:

Introduction to finite volume methods and control volume formulation, Discretization techniques, Applications of FVM, Implementing FVMs in Python.

UNIT-V:

Application of computational methods in civil engineering Different case studies.

Textbooks:

1. Eric Matthes (2019). Python Crash Course: A Hands-On, Project-Based Introduction to Programming. No Starch Press.
2. Al Sweigart (2015). Automate the Boring Stuff with Python: Practical Programming for Total Beginners. No Starch Press.

Reference Books:

1. Wes McKinney (2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy, and I Python. O'Reilly Media.
2. Jaan Kiusalaas (2013). Numerical Methods in Engineering with Python 3. Cambridge University Press.
3. Randall J. Le Veque (2007). Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems. SIAM.
4. Randall J. Le Veque (2002). Finite Volume Methods for Hyperbolic Problems. Cambridge University Press.
5. Numerical Methods for Engineers, Steven Chapra and Raymond Canale, Seventh Edition, McGraw Hill, 2015.
6. John M. Zelle (2010). Python Programming: An Introduction to Computer Science. Franklin, Beedle & Associates Inc.

SEMESTER-VIII									
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**		**CREDITS**	**L**	**T**	**P**	**HRS**
1	CEO-80x	***CEO-801 Environmental Pollution Control / CEO-802 Water Resources Engineering/ CE0-803 Earthquake Resistant Design/ CEO-804 Advanced Geomatics/ Other OEC through SWAYAM (two OECs to be opted by students)***	Theory	OEC	3	3	0	0	3
2	CEO-80x		Theory	OEC	3	3	0	0	3
i	CEP-801	Project	Project-IV	PROJ	6	0	0	12	12
				Total	**12**	6	0	12	18

SEMESTER-VIII

ENVIRONMENTAL POLLUTION CONTROL (OEC)

CEO-801

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course student should be able to:

1. understand the significance of air pollution and its impact identification
2. analyze and solve problems of air pollutants dispersion as well as to design solutions for air pollution control devices
3. identify, formulate, and analyze problems related to solid waste and its management
4. understand, analyze and control noise pollution
5. analyze the impacts of projects on environment and its management plan

SYLLABUS

UNIT-I:

Air Pollution – an Overview, meteorology, plume rise, plume behavior, dispersion of pollutants, factors affecting dispersion, Gaussian dispersion model, assumptions, applications and limitations.

UNIT-II:

Particulate and gaseous contaminants, control devices, constructional features, working principle, design of control devices for particulate and gaseous contaminants.

UNIT-III:

Physical and chemical characteristics of solid waste, elements of solid waste management system, solid waste treatment and disposal, land filling operations.

UNIT-IV:

Definition and fundamental concepts of noise pollution, sources and effects of noise, noise standards, noise propagation and noise from multiple sources, measurement techniques, noise pollution control.

UNIT-V:

Definition, need of EIA, attributes of EIA, different techniques of EIA, impact assessment and development o f environmental management plan.

Textbooks:

1. Environmental Pollution Control Engineering by C S Rao, Published by Wiley Science
2. Air Pollution: Its Origin and Control by Wark Kenneth Jr., Wayne T. Davis, Cecil F. Warner Prentice Hall
3. Air Pollution Control Engineering, 2nd Edition by Neol De Nevers, Mc Graw Hill
4. Environmental Engineering, Howard S. Peavy, Donald R. Rowe, George Tchobanoglows, Published by Tata Mc Graw-Hill, New Delhi

Reference Books:

1. Textbook of Noise Pollution and its Control by S. C. Bhatia, Atlantic Publisher
2. Introduction to Environmental Engineering and Science by Glibert M. Masters published by Dorling Kinderslay India
3. Environmental Impact Assessment by P R Trivedi, PHP Publisher

WATER RESOURCES ENGINEERING (OEC)

CEO-802

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. formulate and apply statistical models to water resources management problems
2. understand the mechanisms of sediment transport and estimate the useful life of reservoir under sedimentation
3. estimate design floods and devise strategies for mitigation of flood related disasters
4. identify environmental issues related to hydropower production in India
5. design river training works for different kind of rivers

SYLLABUS

UNIT-I:

Gravity Dams: Forces acting on the Dam, Combinations of load on the Dam, Design criteria for Gravity Dams, Principal and Shear stresses, Elementary and Practical Profile of a Gravity Dam, Stability Analysis of a Gravity Dam, Design of Gravity Dams

UNIT-II:

Estimation of reservoir yield and storage capacity of reservoirs, firm yield, secondary yield, Mechanism of sediment transport, sediment load, bed load, suspended load, reservoir sedimentation, trap efficiency, capacity-inflow ratio, measures for control of reservoir sedimentation, estimation of useful life of reservoir

UNIT-III:

Introduction to statistical methods in water resources, probability distributions, Floods and their management, Probable maximum flood, standard project flood, flood estimation techniques, classification of methods of flood control, flood plain management, flood damages, methods for estimation of flood damages

UNIT-IV:

General arrangement of hydroelectric projects, hydropower development of India and the world, major hydroelectric projects in India, comparison with thermal and nuclear plants, environmental issues related to hydropower production, firm and secondary power, power duration curves, reliability of hydropower production, illustrative examples

UNIT-V:

River morphology; classification of rivers and river training works, methods of river training works, marginal embankments, guide bunds, groynes, cutoffs, bank pitching and launching aprons, design of guide bunds.

Textbooks/ Reference Books

1. Statistical Methods in Water Resources, D.R. Helsel and R.M. Hirsch
2. Water Resources Engineering, Larry W Mays
3. Water Resources Engineering, R. K. Linsley et al.
4. Water Resources Engineering, S K Garg
5. Applied Hydrology, V. T. Chow et al.
6. Irrigation Water Resources and Waterpower Engineering, P. N. Modi

EARTHQUAKE RESISTANT DESIGN (OEC)

CEO-803

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. comprehend the concept of strong seismic motion and dynamics of structure.
2. apply equivalent static lateral force method for calculation of design forces in structures.
3. apply dynamic methods for calculation of design forces in structures
4. carry out ductile detailing of RCC structures and earthquake resistant design of masonry buildings as well as retrofitting.

SYLLABUS

UNIT-I:

Strong ground motions and Dynamics of Structure: Introduction, Terminology of Strong Ground Motion, Nature of Ground Motion: source effect, Path effect, site effect, Amplitude, peak ground acceleration, vertical acceleration.

Dynamics of Structure: various terms used in the vibration analysis: Simple harmonic motion, free or natural vibrations, damping, damping coefficient, mass and stiffness; Modelling of Structure, lumped mass approach, equation of Motion, Free and forced vibration of Structure, System of Multiple Degrees of Freedom, Response Spectrum.

UNIT-II:

Effects and Behaviour of structures under Earthquake: Introduction, Natural time period of site and structure, Liquefaction of soil, Restoring force, Damping, Effects of Structural Irregularities. Seismo-resistant Building Architecture, Introduction of IS 1893:2016, Design Philosophy, Use of IS 1893:2016 and Determination of Design Lateral Forces using Equivalent Static Lateral force Method.

UNIT-III:

Determination of Lateral Forces: Determination of Design Lateral Forces using Response Spectrum Method, Time History Method. (Eigen values and Eigen vectors, modal participation factors, modal mass, Use of ABS, SRSS, CQC methods)

UNIT-IV:

Ductility Considerations: Introduction, Assessment of Ductility, Factors Affecting Ductility, ductile detailing as per IS 13920: 2016, Load transfer mechanism of joints, Earthquake Resistant Design of Masonry Buildings and Retrofitting: Behaviour of masonry building under earthquake, Methods of Retrofitting, Restoration and Strengthening of existing buildings.

Textbooks / Reference Books:

1. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
2. Elements of Structural Dynamics by Glen V. Berg, Prentice Hall Englewood Cliffs, New Jersey.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education
4. Geotechnical Earthquake Engineering by Steven L. Kramer, Pearson Education

ADVANCED GEOMATICS (OEC)

CEO-804

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. understand fundamental of astronomy for determination of direction and position on the earth surface.
2. understand state-of-art methods of GNSS coordinates measurements.
3. understand and apply principles of photogrammetry for determination of distance and elevation.
4. learn basic principles of remote sensing for application in civil engineering.
5. understand basic principles of GIS for applications in civil engineering.

SYLLABUS

UNIT-I:

Field Astronomy: Astronomical terms, coordinate systems, solution of astronomical triangle; kinds of time, conversion of time; corrections to the observed altitude; determination of azimuth and latitude

UNIT-II:

Coordinate systems, projections and map numbering system, shape of earth and concept of different heights; Introduction, principle and applications of Global Navigation Satellite System (GNSS)

UNIT-III:

Photogrammetry: Introduction, geometric characteristics of aerial photograph, scale of a vertical and tilted photograph; determination of horizontal ground length from photo-coordinates; relief displacement; flight planning; image parallax and stereoscopy

UNIT-IV:

Basics of Remote Sensing: Introduction, principles, electromagnetic energy and its interaction with matter; spectral signature, various sensors and platforms

UNIT-V:

Basics of Geographic information system (GIS): Introduction, components, data models, overlay and spatial analysis

Textbooks:

1. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf. 14th Edition, Prentice Hall, 2014.
2. Surveying-Bannister, Raymond and Baker, Pearson Education
3. Remote Sensing and Image Interpretation by Lillesand and Kiefer, John Wiley & Sons, Inc.
4. Principles of Geographic Information Systems by Burrough, P.A. and McDonnell R.A., Oxford: Clarendon Press.

Reference Books:

1. Surveying and Levelling, T. P. Kanetkar and S. V. Kulkarni Vol.1 & 2, Vidhyarthi Griha, Prakashan, Pune
2. Plane and Geodetic Surveying for Engineers, David Clark and Jackson J. E., CBS Publications and distributors, New Delhi.
3. Advanced Surveying, Agor, Khanna Publications, Delhi. An Introduction to Geographical Information

HONORS DEGREE - STRUCTURAL ENGINEERING								
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**	**CREDITS**	**L**	**T**	**P**	**HRS**
		IV Semester						
1	CEH-431	Sustainable Materials and Green Buildings	Theory	3	2	1	0	3
	.	V Semester						
2	CEH-531	Advanced Concrete Technology	Theory	3	2	1	0	3
		VI Semester						
3	CEH-631	Elementary Finite Element Analysis	Theory	3	2	1	0	3
		VII Semester						
4	CEH-731	Structural Dynamics	Theory	3	2	1	0	3
		VIII Semester						
5	CEH-831	Design of Bridges	Theory	3	2	1	0	3
i	CEP-821	Honors Degree Project	Project	3	0	0	6	6
	*One Project of 3 credits in lieu of 3 Labs		Total	**18**	10	5	6	21

SUSTAINABLE MATERIALS AND GREEN BUILDINGS

CEH-431

Semester IV

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand the concepts of life cycle energy, embodied energy and operational energy of buildings.
2. select materials with low embodied energy
3. identify the factors affecting operational energy and indoor environmental quality.
4. learn strategies to reduce operational energy through passive design and alternate energy sources.
5. understand the codal provisions to achieve green building design and rating systems for their assessment.

SYLLABUS

UNIT-I: Introduction

Introduction, Embodied energy, Operational energy in Building and Life cycle energy. Ecological footprint, Bio-capacity and calculation of planet equivalent, Role of Material: Carbon from Cement, alternative cements and cementitious material, Sustainability issues for concrete.

UNIT-II: Embodied Energy

Role of quality, minimization of natural resource utilization, Embodied energy of concrete, low embodied energy concrete, recycled aggregate, Embodied energy of clay Bricks, kilns.

UNIT-III: Operational Energy and Indoor Environmental Quality

Operational energy in building, role of materials, Indoor environmental quality, Thermal and visual performance.

UNIT-IV: Renewable Energy Sources and Passive Design Strategies

Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings, basic concepts, and efficiency, Passive design strategies, Optimization for design of building for energy efficiency, Effects of trees and microclimatic modification through greening.

UNIT-V: Codal Provisions and Ratings

Energy codes, Energy conservation building code (ECBC) requirement, Concepts of Overall thermal transfer value (OTTV)**,** Green Performance rating, requirements of LEED, GRIHA, Case study.

Textbooks / Reference Books:

1. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology-Processes, 1st Edition, Elsevier, 2003
2. Ministry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency, 2018,
3. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1st ed. Nabhi Publication, 2008.
4. Clarke, J.A., Energy Simulation in Building Design, Adam Hilger Ltd. 1985.
5. TERI-Griha's Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
6. Leadership in Energy and Environmental Design (www.usgbc.org/LEED)

ADVANCED CONCRETE TECHNOLOGY

CEH-531

Semester V

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. understand the ingredients and properties of concrete.
2. conduct the tests on fresh and hardened concrete and apply the results.
3. design normal concrete mixes and apply statistical quality control techniques to concrete quality.
4. identify, describe and choose suitable form of concrete for a particular use at sites.
5. design micro- and nano-concrete composites.

SYLLABUS

UNIT-I: Concrete and its Constituent Materials

Effect of age on strength of concrete, fatigue and impact strength, shrinkage, creep and porosity, Admixtures and construction chemicals: types, method of mixing, effect on different properties of concrete, Rheological properties of concrete: Behavior, Measurement, Affecting factors, Mixture adjustment.

UNIT-II: Quality Control and Assessment

Test on Fresh and Hardened concrete, split tensile strength, compressive strength using Non-Destructive Testing Method, Evaluation of air content in concrete, Optimization of dosage of super plasticizer in concrete, Non-Destructive testing in concrete, inspection, RCPT test, Permeability test.

UNIT-III: Durability of Concrete

Temperature problem in concrete, saline environment, sulphate and acid attack, fire resistance, concrete in extreme climate permeability, corrosion and carbonation, Deterioration of concrete and its prevention.

UNIT-IV: Special Concrete and Concreting Techniques

Fibre Reinforced Concrete, Fly Ash Concrete, Polymer Concrete, Geo-polymer Concrete, Ferro Cement Concrete, High Performance Concrete, Sulphur Concrete and Sulphur Infiltrated Concrete, Light Weight Concrete, Permeable Concrete, Self-Compacting Concrete, High Density Concrete, Pre-Placed Aggregate Concrete and Air Entraining Concrete, Ready Mix Concrete, Working of Batching Plants. Concreting techniques: Pumping, Grouting, Underground construction, underwater construction, Concrete construction in marine environment.

UNIT-V: Micro & Nano Concrete Composites

Micro and Nano concrete composite, micro technology, Nano technology, Nano technology for cementitious composites, petrographic studies on concrete (microstructure characterization using microscope), XRD, SEM with EDX & TEM analysis.

Textbooks/Reference Books:

1. Neville, A.M. and Brookes, J.J., "Concrete Technology", 2 nd Edition, Pearson Education, 2010.
2. Gambhir, M.L., "Concrete Technology", 2nd Edition, Tata McGraw Hill Publishers, New Delhi, 2009.
3. Krishna Raju. N, "Design of Concrete Mixes", 2nd Edition, CBS Publishers and Distributors, 2009.
4. Shetty, M.S., "Concrete Technology", 3rd Edition, S. Chand Publications, 2008.

ELEMENTARY FINITE ELEMENT ANALYSIS

CEH-631

Semester VI

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, the student should be able to:

1. apply basic concepts of Finite elements
2. understand the stress-strain relations and basic FEM equations
3. apply loads and analyze using finite element analysis
4. use force / displacement base method for solution of finite element problems
5. use shape functions and apply boundary condition using finite element analysis

SYLLABUS

UNIT-I:

Background of finite element analysis**,** Numerical Methods, Concepts of Elements and Nodes, Degrees of Freedom, Idealization of a Continuum, Discretization Techniques, Concepts of Finite Element Analysis, Advantages and Disadvantages of FEA.

UNIT-II:

Introduction to Elasticity, Equation of Equilibrium, Strain and stress relation, Green Langrange's equation, Two-Dimensional Stress Distribution, Plane strain and stress problem.

UNIT-III:

Loading and Support Conditions of FEM, Type of Engineering Analysis (Type of excitation (loads), Type of structure (material and geometry), Type of response, Element Library in FEA Software.

UNIT-IV:

Principle of Virtual Work, Variational Principle, Weighted Residual Method, Galerkin Method, Galerkin Method for 2-D Elasticity Problem, Galerkin Method for 2D Fluid Flow Problem.

UNIT-V:

Convergence criteria, Geometric invariance, Shape Function, Degree of Continuity, Isoparametric Elements, Various Elements, Stiffness Matrix and Boundary Conditions.

Textbooks/Reference Books:

1. Finite Element Analysis for Engineering and Technology, Tirupathi R. Chandraputla, Universities Press Pvt. Ltd, Hyderabad. 2003.
2. Finite Element analysis – Theory & Programming by C. S. Krishna Murthy- Tata Mc. Graw Hill Publishers
3. A First Course in the Finite Element Methods by Daryl Logan, Cengage Publisher
4. K. J. Bathe and Wilson: Finite element procedures

STRUCTURAL DYNAMICS

CEH-731

Semester VII

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, student should be able to:

1. comprehend the fundamental concepts of dynamics of structures
2. obtain the free vibration response of single degree of freedom (SDOF) system
3. obtain the forced vibration response of single degree of freedom (SDOF) system
4. obtain the response of two degrees of freedom (TDOF) system
5. understand the dynamic analysis of multi degree of freedom (MDOF) system

SYLLABUS

UNIT-I: Introduction to Dynamic Analysis and Modelling of Structure

Introduction, Sources of dynamic loading, concepts of oscillation and SHM, Restoring forces; Inertia force, damping force, Elastic force. Modelling of structure; Lumped mass approach, Equation of motion, Mathematical and structural modelling.

UNIT-II: Dynamics of Single Degree of Freedom Systems (SDOFs)

Un-damped and damped vibrations, Free vibrations, Transient and Steady-state response, Impulse response, Types of damping and logarithmic decrement.

UNIT-III: Forced vibration of SDOFs

Un-damped forced vibration, Dynamic amplification factor for response, Damped forced vibration, Resonant frequency and half power band width, Force transmission and isolation.

UNIT-IV: Two Degree of Freedom System

Matrix Formulation, Free Vibration, Modes of vibration, Beat phenomenon, Principle of damped and un-damped vibration absorbers.

Unit-V: Dynamics of Multi-Degree of Freedom Systems (MDOFs)

Equations of motion for MDOF systems; Algebraic Eigen-value problem and free vibration analysis; Un-damped and damped normal modes; Mode superposition method for dynamic analysis of linear systems; Modal Analysis.

Textbooks:

1. Dynamics of Structures by A. K. Chopra, PHI Learning, 2006.
2. Structural Dynamics- Theory and Computation, Mario Paz and William Leigh, 5th Edition, 2004

Reference Books:

1. Dynamics of Structures by J. L. Humar, Taylor & Francis, 2002.
2. Fundamentals of Structural Dynamics by R. R. Craig and A. Kurdila, John Wiley & Sons, 2006.
3. Fundamental Concepts of Earthquake Engineering by R. Villaverde, Taylor and Francis, 2008.

DESIGN OF BRIDGES

CEH-831

Semester VIII

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, student should be able to:

1. understand fundamental principles and specifications for conceptual bridge design.
2. analyse and design piers, abutments, and foundations considering various forces.
3. select and design bearings, joints, and appurtenances for bridge integrity.
4. design plate girder and truss bridges.

SYLLABUS

UNIT-I: Introduction

Basics of conceptual bridge design, investigations for bridges, Standard Specifications for Road Bridges, Standard Specifications for Rail Bridges, general design considerations

UNIT-II: Piers, Abutments, and Foundations

Piers, abutments, pier caps, forces due to wave action and collision, foundations for bridges: scour, grip length, shallow foundation, pile foundation, well foundation, pneumatic caisson

UNIT-III: Bridge Bearings, Joints, and Appurtenances

Types of bearings, bearings for different bridges, bridge joints, bridge appurtenances: handrails, footpaths, drainage arrangements, wearing course, approach slab, river training works

UNIT-IV: Steel Bridges

Design of plate girder bridges, design examples of plate girder bridges, design of steel truss bridges, design of suspension bridges.

Textbooks:

1. Concrete Bridge Practice Analysis, Design and Economics by V. K. Raina, Tata McGraw-Hill
2. Bridge Engineering by S. Ponnuswamy, Tata McGraw-Hill
3. Essentials of Bridge Engineering by D. J. Victor, Oxford and IBH Publishing Co. Pvt. Ltd.
4. Design of Bridges by N. Krishna Raju, Oxford and IBH Publishing Co. Pvt. Ltd.
5. Design of Bridge Structures by T. R. Jagadeesh and M. A. Jayaram, Prentice Hall of India Pvt. Ltd.
6. Bridge Deck Behaviour by E. C. Hambly, E & FN Spon Publications
7. Bridge Superstructure by R. Rajagopalan, Tata McGraw-Hill Publishing Company Limited
8. Design of Steel Structures Vol II by Ramchandra, Standard Book House, Delhi

References:

1. IRC: 5-2015 – Standard Specifications and Code of Practice for Road Bridges, Section I: General Features of Design
2. IRC: 6-2017 – Standard Specifications and Code of Practice for Road Bridges, Section II: Loads and Stresses
3. IRC: 18-2000 – Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete)
4. IRC: 21-2000 – Standard Specifications and Code of Practice for Road Bridges, Section III: Cement Concrete (Plain and Reinforced)
5. IRC: 24-2010 – Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges
6. IRC: 78-2014 – Standard Specifications and Code of Practice for Road Bridges, Section VII: Foundations and Substructure
7. IRC: 83 (Part 1) - 2019 – Standard Specifications and Code of Practice for Road Bridges, Bearings, Part I: General Design Requirements
8. IRC: 83 (Part 2) - 2019 – Standard Specifications and Code of Practice for Road Bridges, Bearings, Part II: Elastomeric Bearings
9. IRC: 83 (Part 3) - 2019 – Standard Specifications and Code of Practice for Road Bridges, Bearings, Part III: Pot, PTFE, and Disc Bearings
10. IRC: 87-1984 – Guidelines for Design and Erection of Falsework for Road Bridges
11. IRC: 112-2011 – Code of Practice for Concrete Road Bridges
12. IRC: 113-2015 – Guidelines for the Design, Construction, and Maintenance of Segmental Bridges

HONORS DEGREE - ENVIRONMENTAL ENGINEERING								
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**	**CREDITS**	**L**	**T**	**P**	**HRS**
		IV Semester						
1	CEH-411	Ecology and Environment	Theory	3	3	0	0	3
		V Semester						
2	CEH-511	Transport of Water and Wastewater	Theory	3	3	0	0	3
		VI Semester						
3	CEH-611	Environmental Modeling	Theory	3	3	0	0	3
		VII Semester						
4	CEH-711	Safety and Health in Construction Industry	Theory	3	3	0	0	3
		VIII Semester						
5	CEH-811	Advanced Pollution Control Technologies	Theory	3	3	0	0	3
i	CEP-821	Honors Degree Project	Project	3	0	0	6	6
*One Project of 3 credits in lieu of 3 Labs			Total	**18**	15	0	6	21

ECOLOGY AND ENVIRONMENT

CEH-411

Semester IV

L:3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students will gain the ability to:

1. understand the basic concepts of ecology, ecosystem and environment
2. understand the ecosystem dynamics and concept of various ecological models
3. understand the concept of biodiversity
4. understand the common types of environmental pollution their causes, impacts and control measures
5. understand specific types of environmental pollution their causes, impacts and control measures

SYLLABUS

UNIT-I:

Basic Concepts of Ecology - Ecological Hierarchy, Scope of Ecology, Habitat & Ecological Niche, Ecological Principles, Ecological Community - Structure and Characteristics of a Community, Stratification, Ecotone, Ecological Dominance, Seasonal and Diurnal Fluctuation, Periodicity, Turnover, Interdependence; Ecological Succession - Types and Process of Succession, Climax Community; Range of Tolerance.

UNIT-II:

Functions and Properties of Ecosystem, Ecosystem Dynamics; Models for Energy Flow Ecological Productivity, Ecological Pyramid, Biomagnifications, Biological Control; Population Ecology, Population Growth Models

UNIT-III:

Biodiversity - Types of biodiversity, Patterns of biodiversity, Bio-geographical classification of World, Bio-geographical classification of India, Functions of biodiversity, Hotspots of biodiversity, Bio informatics, Eco Regions, Role of Traditional Knowledge in Biodiversity, Biopiracy. Threats to biodiversity, Causes of Biodiversity losses, Effects of Loss of Biodiversity, Extinction of species, Mass Extinction, IUCN Red List and Classification.

UNIT-IV:

Air Environment - Concepts related to Air pollution, Smog and its impact, Ozone depletion, Acid rain, National Air Quality Index; Marine Pollution (Water Environment) - Sources of marine pollution, Effects of marine pollution, Concept of dead zone, Concept of Ocean acidification.
Noise Pollution - Causes of Noise pollution, Noise Levels, Effects of Noise Pollution on human health, Corrective actions.

UNIT-V:

Thermal Pollution - Causes of Thermal Pollution, Effect of Thermal Pollution, Control of Thermal Pollution, Radioactive Pollution - Sources of Radioactive Pollution, Harmful effects of Radioactive Pollution, Corrective actions. Microplastics in environment, sources of microplastics, harmful effects of microplastics, corrective actions.

Textbooks & Manual:

1. Singh Vir (2024) “Textbook of Environment and Ecology” Springer Singapore.
2. Anna Sher and Manuel Molles (2018) “Ecology: Concepts and Applications” McGraw Hill
3. Arun Luiz T and Mayank M Dalal (2021) “Environmental Science” S Chand.

TRANSPORT OF WATER AND WASTEWATER

CEH-511

Semester V

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students will gain the ability to:

1. understand basic concepts of water transport and pipe system used for this purpose
2. apply the concept of water transport in the design of water distribution systems
3. understand various pipe appurtenances and methods of prevention of water losses
4. understand and apply the concepts of sewer design
5. understand different sewer appurtenances their uses and construction of sewers

SYLLABUS

UNIT-I:

Basic concept of transport of water and wastewater; Gravity system and Pressure system of water transport. Pipes used in transport – material, merits and demerits, Joints in pipes. Design for external loads. Different techniques of pipe laying.

UNIT-II:

Water Distribution Networks – Components, Types of Water Distribution Networks and their uses; Hydraulics of pipe network design; Layouts of Distribution Network; Pipe network analysis; Hardy Cross method. Introduction to relevant software and smart water distribution system.

UNIT-III

Pipe appurtenances – different types of valves used in water supply system, their functions; Water Losses and Control: Water-losses in water supply systems; Concepts of NRW and UFW; Apparent and real losses; water loss detection methods; water losses reduction strategies, Introduction to Asset Management.

UNIT-IV:

Basic concepts in the design and construction of sanitary sewers, Shapes of sewers - Circular and non-circular sections with merits and demerits; design of sewer networks. Separate system, Combined system, Partially separate system; Basics of sewage pumping station design, Introduction to relevant software.

UNIT-V:

Sewer appurtenances – Manhole, Drop manhole, Lamp hole, Street inlets, Catch basin, Flushing device, Sand, grease and oil traps, Inverted siphon, Sewer outlet, Ventilating shaft. Construction of sewers - Setting out, Alignment and gradient, Excavation of trench, Timbering of trench, Dewatering of trench, Testing of sewer - Straightness, Obstruction, Water and Air tests, Backfilling of trench, Introduction to Asset Management.

Textbooks & Manual:

1. Text Book of water supply and sanitary Engineering; S.K.Hussain, Oxford and IBH
2. Water supply & Sanitary Engg.: Vazirani & Chandol, Khanna Publishers
3. Municipal and Rural Sanitation: Ehlers & Steel, Mc Graw hill book
4. Elements of Public Health Engineering: K.N.Dugga, S.Chand & Co.

ENVIRONMENTAL MODELLING

CEH-611

Semester VI

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students will gain the ability to:

1. understand basic concepts of environmental modelling
2. understand different methodologies for simulation
3. understand the concept of reactor models
4. understand the transport models for different media
5. understand the modelling for specific substances in specific environment

SYLLABUS

UNIT-I:

Introduction to environmental modelling, Elements of environmental modelling, Approaches to modelling, development process and applications; Model classification and evaluation; Basics of Environmental System Design; Introduction to Software Packages including MATLAB.

UNIT-II:

Lumped and distributed parameter models, solution methods using MATLAB; Simulation methodologies, continuous, discrete, Monte - Carlo, agent-based, game theory, system dynamics

UNIT-III:

Design of experiments, Reactor Modelling, kinetics, parameter estimation, Resistance Time Distribution (RTD) studies and flow regimes; Cluster analysis.

UNIT-IV:

Modelling transport phenomena, atmospheric and porous media transport and transformation of pollutants; Commonly used models - Air pollution models, water pollution models, noise models, groundwater flow models.

UNIT-V:

Microbial dynamics. Mixing in lakes, river self-purification. dynamics of DO, BOD and nutrients, modelling transport phenomena. atmospheric and porous media transport and transformation of pollutants.

Textbooks & Manual:

1. Schnoor Jerald S (1996) “Environmental Modeling - Fate and Transport of Pollutants in Water, Air, and Soil” Wiley
2. Gray WG and Gray GA (2017) “Introduction to Environmental Modeling” Cambridge Univ Press

SAFETY AND HEALTH IN CONSTRUCTION INDUSTRY

CEH-711

Semester VII

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students will gain the ability to:

1. recognize the concept of safety and occupational health management and related osha guidelines
2. understand the concept of industrial hygiene and identify chemical hazards and their control measures
3. identify hazards and control measures associated with excavation, trenching, and scaffolding
4. identify hazards and control measures associated with electro-mechanical operations and falls
5. identify hazards and control measures associated with confined space entry and understand the record keeping for illness and injuries

SYLLABUS

UNIT-I:
Occupational health – definition, health hazards, environmental safety, occupational health and environmental safety management, basic principles of occupational health and environmental safety management, OSHA regulations and procedures; occupational health and environment safety management system, ISO, ILO and EPA Standards, BOCW act; Common occupational diseases; occupational health management services at the workplace.

UNIT-II:
Industrial hygiene - definition, control methods personal hygiene, housekeeping and maintenance, waste disposal, special control measures; introduction to chemical hazards, dangerous properties of chemical, dust, gases, fumes, mist, vapours, smoke and aerosols; route of entry to human system, recognition, evaluation and control of basic hazards, concepts of dose response relationship, bio-chemical action of toxic substances. concept of threshold, limit values.

UNIT-III:
Requirements for safe construction; safety aspects of excavation and trenching; excavation hazards and control measures, OSHA's Excavation Standard; hazards associated with scaffold design, assembly, disassembly and use, types of scaffolds, determining scaffold capacity; use of scaffolding using OSHA’s construction scaffold standards as a guide.

UNIT-IV:
Safe operation and handling of high-powered bolting tools, pressure vessels and piping, machinery or mechanical joints, and structural connections; hazards associated with electrical installations and equipment; fall hazards and their prevention, fall hazards - principles of fall protection, the components of fall arrest systems, the limitations of fall arrest equipment, and OSHA policies regarding fall protection.

UNIT-V:
Safety and health hazards associated with confined space entry, and the evaluation, prevention, and abatement of these hazards, OSHA guidelines for Permit-Required Confined Space Entry; OSHA requirements for maintaining and posting records of occupational injuries and illnesses and reporting specific cases to OSHA.

Textbooks & Manual:

1. Allan St John Holt BA, FIOSH, RSP (2001) Principles of Construction Safety, Blackwell Science Ltd.
2. Skelton, B. (1997). Process safety analysis, Gulf Publishing Company, Houston
3. Anil Sawhney, Gao Shang, Patrick Manu, Paulo Jorge Silva Bartolo, Valerie Francis (2023) Handbook of Construction Safety, Health and Well-being in the Industry, CRC Press
4. Lees, F.P. (1996). Loss Prevention in Process Industries: Hazard identification, Assessment and Control, Vol. 1-3, Butterwort-Heinemann, Oxford

ADVANCED POLLUTION CONTROL TECHNOLOGIES

CEH-811

Semester VIII

L: 2 T: 1 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students will gain the ability to:

1. understand advanced methods for removal of specific air pollutants
2. understand control of indoor air pollution and control of odour
3. understand different noise models and their applications
4. understand advanced methods of wastewater treatment
5. understand advanced methods of water treatment

SYLLABUS

UNIT-I:

Air Pollution – an overview, control of gaseous pollutants – description of basic control principles (absorption, adsorption, condensation and combustion), constructional features, working principle, advantages, disadvantages and applications of various gaseous control devices; control of particulates – description of control principles involved in various particulate control devices, constructional features, working principle, advantages, disadvantages and applications of various particulate control devices

UNIT-II:

Indoor air pollution – definition, indoor air pollutants and their sources, impacts of indoor air pollution, odor pollution – sources of odor, different biological and non-biological methods of odor control; radon pollution – sources of radon pollution, health impacts, methods of control; indoor air quality prediction models, indoor air quality management, emerging technologies for control of air pollution

UNIT-III:

Noise modelling, types of models, noise model advantages, disadvantages and limitations, noise model applications, noise management, noise prediction models. Noise Pollution, noise pollution control – control at source, control during transmission and control at receptor end.

UNIT-IV:

Basics of advance wastewater treatment technologies, aerobic and anaerobic treatment techniques and their advantages/disadvantages, limitations and applications, description of advance suspended growth systems such as Sequencing Batch Reactors (SBR) and Membrane Bioreactors (MBR) and their working principles; basic description and working principle of attached growth systems such as Moving Bed Bio-film Reactors (MBBR)/Fluidized Aerobic Bioreactor (FAB), Submerged aerobic Fixed Film (SAFF) reactor etc

UNIT-V:

Demineralization of water, different types of demineralization process and their advantages/disadvantages, applications and limitations, the process description of microfiltration, nano-filtration, ultra-filtration, ion exchange and reverse osmosis, basics of description and working principles of photo-catalysis and photo-catalytic membranes

Textbooks & Manual:

1. Waste water Engineering: Treatment and Disposal by Metcalf &Eddy, 4th Edition, 2017
2. Wark, K., Warner, C.F., and Davis, W.T., “Air Pollution: Its Origin and Control”, Addison-Wesley Longman. 1998.
3. Wang, Periera and Hung “Advanced Air and Noise Pollution Control” Humana Press, 2005

HONORS DEGREE - WATER RESOURCES ENGINEERING								
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**	**CREDITS**	**L**	**T**	**P**	**HRS**
		IV Semester						
1	CEH-421	Pipeline Engineering	Theory	3	2	1	0	3
	.	**V Semester**						
2	CEH-521	Computational Hydraulics	Theory	3	2	1	0	3
		VI Semester						
3	CEH-621	Earth and Rock Fill Dams	Theory	3	2	1	0	3
		VII Semester						
4	CEH-721	Groundwater Hydrology	Theory	3	2	1	0	3
		VIII Semester						
5	CEH-821	River Engineering	Theory	3	2	1	0	3
i	CEP-821	Honors Degree Project	Project	3	0	0	6	6
	*One Project of 3 credits in lieu of 3 Labs		Total	**18**	10	5	6	21

Semester-IV

PIPELINE ENGINEERING

CEH-421

L:3 T:0 P:0 Cr: 3,

COURSE OUTCOMES

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

1. gain a comprehensive overview of pipeline engineering, specifically tailored to water transmission and distribution systems
2. proficiently design and optimize Water Distribution Networks (WDNs), utilizing the latest tools and software
3. apply methods for pipeline rehabilitation, utilizing case studies of successful rehabilitation projects
4. select appurtenances, choose pipe materials, and master jointing techniques
5. proficiently select, install, and manage various appurtenances such as valves and flow meters

SYLLABUS

UNIT-I: Introduction to Pipeline Systems

Overview of pipeline engineering for water transmission and distribution, Types of pipelines and their applications, Basic principles of fluid flow in pipelines, Analysis of flow in water transmission systems (pump and gravity), Design Considerations- Key issues in designing pipeline systems, Factors influencing pipeline design and operation

UNIT-II: Water Distribution Systems Analysis and Design

Optimal Design of Water Distribution Networks (WDN), Goals and methods for optimal design, Latest tools and software for optimization, Extended Period Simulations- Importance of dynamic analysis in WDN, Techniques for extended period simulations, Introduction to WDN analysis and design software.

UNIT-III: Rehabilitation and Maintenance of Pipelines

Methods for pipeline rehabilitation, Case studies of successful rehabilitation projects, Water Auditing and Monitoring, Leak and Burst Detection, Transient Analysis and Surge Protection Design and implementation of surge protection measures.

UNIT-IV: Pipeline Components and Materials

Appurtenances- Types of valves, flow meters, and other control devices, Selection and installation of appurtenances, Pipe Materials-Criteria for selecting pipe materials, Comparison of different materials, Jointing Techniques- Overview of jointing methods, Best practices for ensuring secure joints.

UNIT-V: Construction and Structural Design of Pipelines

Procedures for laying pipelines, Testing methods to ensure integrity and functionality, Structural design for buried pipelines and surface-mounted pipes, Innovations in pipeline construction and maintenance, Emerging technologies and future trends in pipeline engineering

Textbooks:

1. Alkazraji, D. (2008). A Quick Guide to Pipeline Engineering. United Kingdom: Elsevier Science.
2. Bhave, P. R. (2003). Optimal Design of Water Distribution Networks. India: Alpha Science International.
3. Antaki, G. A. (2003). Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair. United States: CRC Press.

Reference Books:

1. Singh, R. (2013). *Pipeline Integrity Handbook.* Gulf Professional Publishing.
2. Stephenson, D.J. and Shemang, E.M. (2004). *Pipeline Design for Water Engineers.* 3rd ed. Routledge.
3. McAllister, E.W. (2015). *Pipeline Rules of Thumb Handbook.* 8th ed. Gulf Professional Publishing.
4. Mays, L.W. (2000). *Water Distribution Systems Handbook.* McGraw-Hill Education.
5. Thorley, A.R.D. (2004). *Fluid Transients in Pipeline Systems.* 2nd ed. Professional Engineering Publishing.
6. Lauer, W.C. (2012). *Water Supply Systems and Evaluation Methods.* 2nd ed. Create Space Independent Publishing Platform.

Semester -V

COMPUTATIONAL HYDRAULICS

CEH-521

L:3 T:0 P: 0 Cr: 3

COURSE OUTCOMES

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

1. analyze and apply governing equations for flow and transport in surface water bodies and subsurface flow
2. develop proficiency in finite difference method
3. apply finite volume methods to computational hydraulics
4. solve flow and transport equations
5. proficiently use software for subsurface flow simulation

SYLLABUS

UNIT-I:

Overview of computational hydraulics and its applications in civil engineering, Importance of numerical methods in solving hydraulic problems, Governing Equations for Flow and Transport- surface water bodies, subsurface flow (saturated and unsaturated), reactive transport equations, coupled surface and subsurface flow models.

UNIT-II:

Finite Difference Method (FDM) -Basics of FDM: consistency, stability, and convergence, Order of accuracy and computational efficiency, Application of FDM to solve flow and transport equations,

UNIT-III:

Finite Volume Method (FVM), Fundamentals of FVM, Application of FVM in computational hydraulics, Comparative analysis of FDM and FVM.

UNIT-IV:

Solving Flow and Transport Equations-Fully coupled vs. iteratively coupled models, Model simplification techniques, Parameter Estimation, Techniques for model calibration and validation, Modeling Surface and Subsurface Flow -Techniques for simulating saturated and unsaturated flow.

UNIT-V:

Software for Subsurface flow simulation, Iterative Coupling Techniques-Approaches for iteratively coupled models, Benefits and limitations of iterative coupling., Computational Fluid Dynamics (CFD)software for 3-D turbulent flow modelling.

Textbooks:

1. Popescu, Ioana. *Computational Hydraulics: Numerical Methods and Modelling.* IWA Publishing, 2014.
2. Abbott, M.B. *Computational Hydraulics.* Pitman, 1979.

Reference Books:

1. Brebbia, C.A., and A.J. Ferrante. *Computational Hydraulics.* Butterworths, 1983.
2. Garg, S.K. *Hydraulic Engineering.* Khanna Publishers, 2007.
3. Chapra, Steven C., and Raymond P. Canale. *Numerical Methods for Engineers*. 7th ed. McGraw-Hill, 2015.
4. Anderson, John D. *Computational Fluid Dynamics: The Basics with Applications.* McGraw-Hill, 1995.
5. Chanson, Hubert. *Applied Hydrodynamics: An Introduction.* CRC Press, 2009.
6. Sharma, Atul. *Introduction to Computational Fluid Dynamics.* Cambridge University Press, 2018.
7. Blazek, Jiri. *Computational Fluid Dynamics: Principles and Applications.* 3rd ed. Elsevier, 2015.
8. Jain, M.K., S.R.K. Iyengar, and R.K. Jain. *Numerical Methods for Scientific and Engineering Computation.* 6th ed. New Age International Publishers, 2012.
9. Wang, H.A., and M.P. Anderson. *Introduction to Groundwater Modeling*. Academic Press, 1982
10. https://archive.nptel.ac.in/courses/105/105/105105161/

Semester -VI

EARTH AND ROCKFILL DAMS

CEH-621

L:3 T:0 P: 0 Cr: 3

COURSE OUTCOMES

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

1. implement preventive and remedial measures to address and mitigate cracking in embankment dams
2. evaluate and implement various methods of seepage control in dam design and construction
3. design dam sections and select appropriate types of membranes for rock fill dams
4. conduct comprehensive geotechnical site investigations for dam projects.
5. conduct stability analysis of earth and rock fill dams using various methods, including the method of slices and graphical methods

SYLLABUS

UNIT-I:

Basic design aspects, Classification of embankment dams, Criteria for safe design, Free board, Upstream and downstream slope protection, Cracking of earth dams, Hydraulic fracturing, Causes of cracking, Preventive and remedial measures

UNIT-II:

Seepage theory, Determination of free surface and seepage discharge through dams for isotropic as well as anisotropic soils. Flow net for earth dam under steady seepage condition, Various methods of seepage control, Selection of core materials, Drainage of embankments, Design of transition filters, Use of geo-textiles.

UNIT-III:

General characteristics of Rock fill dams, Materials for rock fill dams, testing of rockfill material Design of dam section, Types of membrane, Rock fill placement, Deformation of rock fill dams, Flow through and over rockfill dam, Concrete faced rockfill dam.

UNIT-IV:

Geotechnical site investigations, Selection criteria for dam sites, Environmental and social impact assessments

UNIT-V:

Stability analysis, Method of slices, Graphical method, Foundation exploration for Earth and Rock fill dams, Treatment of foundations, Quality control and instrumentation, River diversion during construction of dam.

Textbooks:

1. Sharma H. D., Embankment Dams, Oxford and IBH Pub., 1991
2. Sowers G. I. Earth and Rockfill Dam Engineering Manual, USBR Publication

Reference Books:

1. Hind, Creager and Justin, Engineering for dams, Wiley, 1967.
2. Bharat Singh, Embankment Dam Engineering, Nem Chand & Bros Roorkee.
3. Design of Small Dams, USDI, Oxford and IBH, 1976.

Semester-VII

GROUNDWATER HYDROLOGY

CEH-721

L:3 T:0 P:0 Cr: 3,

COURSE OUTCOMES

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

1. evaluate the significance of key engineering properties related to aquifers
2. analyze complex well hydraulics by applying methods such as the Theis equation and Jacob's method
3. interpret resistivity and seismic data obtained from remote sensing techniques
4. design, protect, and maintain different types of wells.
5. evaluate groundwater quality and implement sustainable and environmental friendly management strategies

SYLLABUS

UNIT-I: Introduction to Groundwater Engineering

Importance and significance of groundwater in civil engineering, Groundwater occurrence and movement, Historical development of groundwater science Definitions: aquifers, aquicludes, aquitards, and aquifuges, Types of aquifers: unconfined, confined, and perched, Darcy's Law and its applications, Hydraulic conductivity and permeability, Porosity and specific yield

UNIT-II: Well Hydraulics

Steady and Unsteady Flow, Radial flow to a well in confined and unconfined aquifers, Theis equation and its applications, Jacob's method and other analytical solutions **,** Influence of partial penetration on well hydraulics, Effects of anisotropy and heterogeneity, Multiple Well Systems- Interference among wells, Superposition principle and its applications, Characteristic Well Losses and Specific Capacity Drawdown and its measurement Well losses: linear and nonlinear Determination of specific capacity

UNIT-III: Surface and Subsurface Investigations

Importance of geological studies in groundwater exploration, Types of geological formations and their groundwater potential, Remote Sensing and Geophysical Explorations- Applications of remote sensing in groundwater studies, Electrical resistivity methods, Seismic refraction and reflection techniques Principles and applications in groundwater exploration, Interpretation of resistivity and seismic data

UNIT-IV: Water Wells

Construction and Completion, Types of wells: dug wells, driven wells, drilled wells, Well design and construction materials, Casing, screens, and gravel packs, Development and Rehabilitation- Well development techniques: surging, jetting, and acidizing, Well maintenance and rehabilitation methods, Protection of Wells -Sanitary protection measures, Prevention of contamination and wellhead protection

UNIT-V: Groundwater Quality and Management

Water quality parameters and standards, Sources and types of groundwater contamination, Treatment methods for contaminated groundwater Groundwater Management- Principles of groundwater basin management, Investigations for groundwater management, Groundwater Modeling and Artificial Recharge techniques, Saline Water Intrusion- Causes and effects of saline water intrusion, Control and management strategies

Textbooks:

1. Todd, David Keith, and Larry W. Mays. Groundwater Hydrology. 3rd ed. Hoboken, NJ: Wiley, 2004.
2. Raghunath, H. M. Ground Water. 2nd ed. New Delhi: New Age International Publishers, 2007.
3. Karanth, K. R. Hydrogeology. 1st ed. New Delhi: Tata McGraw-Hill Publishing, 1987.

Reference Books:

1. Ramakrishnan, S. Ground Water. India: S. Ramakrishnan, 1998.
2. Fetter, C. W. Applied Hydrogeology. 4th ed. Upper Saddle River, NJ: Prentice Hall, 2001.
3. Fitts, Charles R. Groundwater Science. 3rd ed. Amsterdam: Elsevier, 2023.
4. Cushman, John H., and Daniel M. Tartakovsky. Groundwater Engineering: A Technical Approach to Hydrogeology, Well Construction, and Groundwater Resources Management. 1st ed. Boca Raton, FL: CRC Press, 2016.
5. Hiscock, Kevin M., and Victor F. Bense. Hydrogeology: Principles and Practice. 3rd ed. Chichester: Wiley-Blackwell, 2014.

Semester-VIII

RIVER ENGINEERING

CEH-821

L: 3 T: 0 P:0 Cr: 3

COURSE OUTCOMES

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

1. comprehend sediment transport mechanics, including sediment properties, bed forms, bed load transport, and transport of suspended sediment
2. analyze the mechanisms of local scour at bridge piers, and develop mitigation strategies for local scour
3. develop stage-discharge relationships, and apply basic scaling laws in physical river modeling, including fixed and movable bed models
4. design various river protection and training works, including embankments, dikes, gabions, spurs, and bank protective measures
5. design and implement diversion and cofferdam systems for sustainable river management.

SYLLABUS

UNIT-I: Introduction to River Morphology

Introduction: River Morphology: Bars; Bends and Meanders, Thalweg; Braiding; Bifurcations and Confluences; Flood Plains; River Channel Migration; River system evolution; Urban rivers and streams Sediment Transport Mechanics: Sediment properties, Bed forms, Bed Load transport, Transport of suspended sediment, Critical Shear stress, Flocculation, Settling, Consolidation, Sediment Transport Equations

UNIT-II: River Aggradation and Degradation

Processes and causes of aggradation and degradation in river channels, Impacts of sediment transport on river bed elevation, Methods for predicting and managing aggradation and degradation, **Local Scour-** Mechanisms of local scour at bridge piers and other hydraulic structures, Factors affecting scour depth and patterns, Predictive models and mitigation strategies for local scour.

UNIT-II: Measurements in Rivers

Stage measurements, Channel geometry, Discharge, Stage Discharge Relationship; Sediment samplers and suspended load measurement; Bed load measurement River Models: Physical Models: Basic Scaling Laws, fixed and movable bed models; Sectional Models, Distorted Models.

UNIT-IV: Mathematical Modeling and River Protection

1D and 2D models for aggradations and degradation; 3D Models for turbulence and local scour River Protection and Training Works: Design of Revetments, Dikes, Gabions, Spurs, Bank Protective measures and Bed control structures, Design of river training and flood protection structures.

UNIT-V: Advanced River Management

Diversion and Cofferdams, River Regulation Systems, Dredging and Disposal, River Restoration**-** Balancing ecological and engineering objectives in river management.

Textbooks:

1. Julien, Pierre Y. River Mechanics. 2nd ed. Cambridge: Cambridge University Press, 2018.
2. Wu, Weiming. Computational River Dynamics. 1st ed. London: Taylor & Francis, 2007.
3. Chang, H. Howard. Fluvial Processes in River Engineering. New York: John Wiley & Sons, 1988.

Reference Books:

1. Yang, Chih Ted. Sediment Transport: Theory and Practice. Reprint ed. New York: McGraw-Hill, 1996.
2. Yalin, M.S. River Mechanics. 1st ed. Amsterdam: Elsevier Science, 2015.
3. Roberson, John C., and John A. Cassidy. Design of Hydraulic Structures. New York: John Wiley & Sons, 1988.
4. Novak, P., A.I.B. Moffat, C. Nalluri, and R. Narayanan. Hydraulic Structures. 4th ed. London: Taylor & Francis, 2007.
5. Przedwojski, B., R. Blazejewski, and K. W. Pilarczyk. River Training Techniques: Fundamentals, Design and Applications. Rotterdam: A.A. Balkema, 1995.
6. Graf, Walter H. Fluvial Hydraulics. Chichester: John Wiley & Sons, 1998.
7. Peterson, Margaret. River Engineering. New York: Prentice Hall, 1999.

MINOR DEGREE - CIVIL INFRASTRUCTURE								
S. NO.	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**	**CREDITS**	**L**	**T**	**P**	**HRS**
		IV Semester						
1	CED-411	Environmental Engineering and Pollution Control	Theory	3	3	0	0	3
		V Semester						
2	CED-511	Building Construction and Concrete Technology	Theory	3	3	0	0	3
i	CEL-521	Concrete Technology Lab*	Lab	1	0	0	2	2
		VI Semester						
3	CED-611	Fundamentals of Surveying	Theory	3	3	0	0	3
ii	CEL-621	Fundamentals of Surveying Lab*	Lab	1	0	0	2	2
		VII Semester						
4	CED-711	Water Resources Management	Theory	3	3	0	0	3
iii	CEL-721	Water Resources Lab*	Lab	1	0	0	2	2
		VIII Semester						
5	CED-811	Geotechnical and Transportation Engineering	Theory	3	3	0	0	3
	*One Project of 3 credits in lieu of 3 Labs		Total	**18**	15	0	6	21

ENVIRONMENTAL ENGINEERING AND POLLUTION CONTROL

CED-411

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand various techniques and technologies for water treatment
2. understand various techniques and technologies for wastewater treatment
3. understand different methods of air pollution control
4. understand impacts of solid wastes, their characterization and methods of disposal
5. understand various policies and regulations for pollution control

SYLLABUS

UNIT-I:

Water demand/consumption, water sources, Overview of water quality – physical, chemical and microbiological, water quality standards, basic description of water treatment unit operations/processes, advantages/disadvantages and applications of various unit operations/processes

UNIT-II:

Wastewater – Overview of generation sources, municipal (sewage) and industrial (effluent) wastewater, characteristics and composition, unit operations and processes involved in preliminary/primary/secondary/tertiary treatment of wastewater; aerobic facultative and anaerobic treatment – definitions; basic descriptions of suspended growth systems and attached growth systems, treated effluent discharge/re-use standards

UNIT-III:

Overview of Air pollutants, sources – natural and anthropogenic, impacts of air pollutants on human health, vegetation, materials and environment, prescribed air quality standards, air quality management – air quality prediction models and their applications, air pollution control strategies, control devices and their advantages/disadvantages and applications

UNIT-IV:

Overview of sources of solid waste, types of solid waste, characteristics and composition of solid waste, solid waste management – definition, elements of solid waste management systems, solid waste treatment, basic description of mechanical treatment shredding/compaction; thermal treatment - incineration, pyrolysis and plasma arc technology etc.; biological treatment – aerobic (composting and vermin-composting) and anaerobic (biomethanation), land filling operations

UNIT-V:

Environmental impact assessment (EIA) – definition, components of environment involved in EIA such as air environment, water/wastewater environment, biological environment, socioeconomic environment, noise environment, solid waste; steps involved in EIA of various components, environmental legislation related to various components, environmental clearance policy, environmental audit

Textbooks:

1. Peavy Howard S, Rowe Donald R, Tchobanglous Geroge (2013), Environmental Engineering, McGraw Hill Education (India) Pvt Ltd
2. Garg S. K. (2020) Sewage Disposal and Air Pollution Engineering, Khanna Publishers

Reference Books:

1. Sincero Arcadio P, Sincero Gregoria A (2010), Environmental Engineering – A Design Approach, Prentice Hall of India
2. CS Rao (2006), Environmental Pollution Control Engineering, New Age International Pvt Ltd. Publishers

BUILDING CONSTRUCTION AND CONCRETE

CED-511

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand various types of building and its components.
2. understand the various loads that act on buildings and basic requirements of a foundation.
3. design building services to fulfil functional requirement of buildings
4. understand the properties of different types of cement.
5. design concrete mixes and conduct tests on cement and aggregates.

SYLLABUS

UNIT-I: Types of buildings and components

Classification of buildings as per National Building Code, Types of Buildings; Load bearing structure, framed structure, composite structure, Components of buildings.

UNIT-II: Loads and foundation

Type of loads on buildings, Foundation: Fundamentals, requirements of a foundation, types of foundations.

UNIT-III: Building Services

Stairs, Lifts and escalators, Plumbing and water supply, HVAC, lighting, sound insulation, Fire safety, and protection, ventilation.

UNIT-IV: Concrete

Types of Portland cement, pozzolanic cement, high alumina cement and other types, hydration mechanism and hydration products, setting and hardening, curing, strength of hardened cement, grade of cement, tests on cements, relevant BIS codes, Properties of coarse & fine aggregates, tests on aggregates, relevant BIS codal provisions, concrete: Ingredients of concrete, properties of fresh and hardened concrete; its tests, additives and their types,

UNIT-V: Modern Concrete

Polymer concrete, fibre reinforced concrete; Ferro-cement; ready mix concrete; self-compacting concrete; Other Materials: Fly-ash, smart materials, composite materials, other modern concretes.

Textbooks:

1. Equipment and Methods, Indian Edition, Mc-Graw Hill-Education, New Delhi.
2. Estimating and costing by B N Datta, S S Dutta and Co.
3. Building construction by B. C. Punmia.
4. Engineering Materials by S.C. Rangwala
5. Properties of concrete by A M Neville

Reference Books:

1. Kumar Neeraj Jha, (2015), Construction Project Management, 2nd Edition, Pearson, New Delhi.
2. Analysis of rates, CPWD
3. National Building code of India (2005).
4. Manual of Tropical Housing and Building, O H Koenisberger.
5. Engineering Materials by R K Rajput.
6. Concrete Technology by M L Gambhir

FUNDAMENTALS OF SURVEYING

CED-611

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course a student should be able to:

1. understand different techniques of distance and direction measurements for determination of horizontal control points for mapping.
2. learn and apply techniques of levelling for determination of elevation of points.
3. prepare topographical maps and apply different methods to compute area and volume for design of civil engineering projects.
4. learn to use total station for detailed mapping and setting out of civil engineering structures.
5. apply methods of setting out of horizontal curves for construction of highways and railways

SYLLABUS

UNIT-I:

Introduction to surveying, concept of plane and geodetic surveying, classification of surveying, basic principles, measurement of horizontal distance by conventional methods, sources of errors; Map Scale, measurement of horizontal angles and bearings, traverse surveying

UNIT-II

Concept and principle of leveling, instruments for leveling, types of spirit leveling, methods of booking and reduction of levels, errors in leveling; Trigonometrical leveling

UNIT-III:

Topographical surveying, concept and characteristics of contours, methods and uses of contours. Computation of area by different methods, estimation of volume of earthwork

UNIT-IV:

Basics of EDM; Applications of total station; Setting out of building and tunnel; reconnaissance, preliminary and detailed survey for canals, highways, railways, sewer lines

UNIT-V:

Elements and geometry of horizontal curves, setting out of simple circular curve by linear and angular methods

Textbooks:

1. Elementary Surveying, Charles D. Ghilani, Paul R. Wolf. 14th Edition, Prentice Hall, 2014.
2. Surveying and Leveling, T. P. Kanetkar and S. V. Kulkarni Vol.1 & 2, Vidhyarthi Griha, Prakashan, Pune

Reference Books:

1. Plane and Geodetic Surveying for Engineers, David Clark and Jackson J. E., CBS Publications and distributors, New Delhi. Advanced Surveying, Agor, Khanna Publications, Delhi.
2. Surveying-Bannister, Raymond and Baker, Pearson Education

WATER RESOURCES MANAGEMENT

CED-711

L:3 T:0 P:0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course, students will gain the ability to:

1. apply the fundamental concepts mathematics, fluid mechanics and specific energy to solve the critical flow and transition problems in open channel flow.
2. learn about the different discharge measuring devices in open channel and pipe flow.
3. understand the hydrology of water cycle, rainfall-runoff relationship and methods of stream flow measurement.
4. comprehend the functions, components, design, and failure theories of diversion headworks.
5. analyze and design reservoirs and dams, including understanding forces, design criteria, and stability analysis.

SYLLABUS

UNIT I:

Introduction: classification of open channel flow. Geometric properties of channel section, Velocity and Pressure distribution in Channel Flow, Kinetic energy and momentum correction factors. Uniform flow, Application of Mannings and Chezy's formula. Specific Energy: Critical Flow, Specific Energy and Force. Transitions in channels. Channel conveyance, section factor for critical flow and uniform flow computations. Most economical section of a channel.

UNIT II:

Measuring Devices in Open Channel: Flow in channels with sharp & broad crested weir. Flow measurement with non-rectangular weirs; Triangular, circular and parabolic weir. Ogee spillway and sluice gate. Bernoulli's principles and measuring devices in pipe flow

UNIT III:

Precipitation: Hydrologic cycle, World's Water balance, Types and Forms of precipitation. Measurement of precipitation. Adequacy of rain gauges. Average rainfall over an area. Surface Runoff: Factors affecting runoff. Rainfall – runoff relationships, empirical equations. Flow duration Curve. Stage discharge relationship. Introduction to ground water hydrology.

UNIT IV:

Diversion Headworks, Weirs and barrages – components, functions, causes of failure; Bligh's creep theory, Lanes's weighted creep theory, Khosla's theory, pressure calculations, Introduction of Canal falls and cross drainage works

UNIT V:

Storage works – Dams, Gravity Dams: Forces acting on the Dam, Combinations of load on the Dam, Design criteria for Gravity Dams, Principal and Shear stresses, Elementary and Practical Profile of a Gravity Dam, Stability Analysis of a Gravity Dams. Embankment dam and its salient features

Textbooks

1. Chow, V.T., 2009. *Open-channel hydraulics*. 2nd ed. New York: McGraw-Hill.
2. Subramanya, K., 2009. *Flow in open channels*. 3rd ed. New Delhi: Tata McGraw-Hill.
3. Novak, P., Moffat, A.I.B., Nalluri, C., and Narayanan, R., 2017. *Hydraulic structures*. 4th ed. Boca Raton: CRC Press.

Reference Books

1. Finnemore, E.J., and Franzini, J.B., 2002. *Fluid mechanics with engineering applications*. 10th ed. New York: McGraw-Hill.
2. Linsley, R.K., Kohler, M.A., and Paulhus, J.L.H., 1982. *Hydrology for engineers*. 3rd ed. New York: McGraw-Hill.
3. Chow, V.T., Maidment, D.R., and Mays, L.W., 1988. *Applied hydrology*. New York: McGraw-Hill.
4. Garg, S.K., 2017. *Irrigation engineering and hydraulic structures*. 31st ed. Delhi: Khanna Publishers.
5. Varshney, R.S., Gupta, and Gupta, R.L., 1979. *Design of irrigation structures*. 4th ed. New Delhi: Oxford & IBH Publishing Co.

GEOTECHNICAL AND TRANSPORTATION ENGINEERING
CED-811

L: 3 T: 0 P: 0 Cr: 3

COURSE OUTCOMES

Upon successful completion of the course students should be able to:

1. understand and identify various soils.
2. understand different types of foundations.
3. gain knowledge on highway planning, project preparation.
4. understand basic concepts of railway track and airport design.
5. gain knowledge of different highway materials and pavements construction.

SYLLABUS

UNIT-I:

Type of soils, Soil Structure and clay minerology, Three Phase System and Phase Relationships, Classification: Unified and IS Classification System, Index Properties.

Unit-II:

Types of foundations: Shallow Foundations: Isolated, strap, Combined and raft foundations; Deep foundations: Pile foundations and Well Foundations; Geosynthetics and their uses in Civil Engineering projects.

Unit-III:

Importance of transportation, a brief history of highway development, highway alignment, engineering and other surveys for highway location, highway projects evaluation.

Unit-IV:

Introduction of railways, railway track, gauge, track components and specifications, formation and cross-section details. Aircraft characteristics, airport planning, site selection, runway and taxiway design.

Unit-V:

Subgrade soil, aggregates and bituminous material, different tests on these materials, construction of flexible, rigid and ICB pavements.

Textbooks:

1. Soil Mechanics and Foundation Engineering by K R Arora, Standard Publishers Distributor
2. Soil Mechanics and Foundation by Punmia, Jain and Jain; Laxmi Publications (P) Ltd.
3. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS Publishers and Distributors Pvt. Ltd.
4. Railway Engineering by Chandra and Agarwal, Oxford University Press.
5. Air Transportation Planning and Design by Saxena, CBS Publisher.
6. Highway Engineering by Khanna, Justo and Veeraragavan, Nem Chand and Bros, Roorkee.

Reference Books:

1. Relevant IRC codes.
2. Transportation Engineering and Planning by Papacostas and Prevedouros, PHI.

IMPORTANT CONTACT NUMBERS

Dean, Students' Welfare (DSW)	011-26980164
Proctor Office	011-26982424
Dean, Faculty of Engg. & Tech.	011-26985831
Head, Department of Civil Engg.	011-26985227
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Department of Civil Engineering

Faculty of Engineering & Technology

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