NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH

RULES AND REGULATIONS SCHEME OF INSTRUCTION AND SYLLABI

B.Tech. – Civil Engineering

Effective from 2024-25

NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH

VISION

- To nurture and produce highly competent engineers, scientists and entrepreneurs committed towards catering to futuristic societal challenges through holistic education synergetic with innovations and vibrant research eco-system.

MISSION

- To implement best practices in teaching-learning methodologies for establishing dynamic knowledge-connected society.
- To create a conducive environment for carrying out research in multi-disciplinary areas and thereby nurturing novel thinking capabilities.
- To strengthen industry-institute interface to inculcate entrepreneurship abilities.
- To address all technological needs of the Nation for self-sustenance.

DEPARTMENT OF CIVIL ENGINEERING

VISION

- To lead the global community by producing outstanding Civil Engineers through quality technical education, research and build the legacy of entrepreneurship who can serve for industry and society through their innovative thinking.

MISSION

- To design a curriculum which caters the present and future challenges and establish a Centre of Excellency in Civil Engineering.
- To carry out novel research, on problems prevalent in society and provide sustainable solutions in various disciplines of Civil Engineering.
- To have industry connect for combating the multi-dimensional problems through collaborations.
- To promote innovative ideas among the students to excel as a future entrepreneur.

Department of Civil Engineering:

About the Department:

The Department of Civil Engineering was established in 2015, along with the setting up of the institute. The Department offers undergraduate with a sanctioned intake of 60 students along with M. Tech and Ph.D. programs. The Department has highly committed faculty who are well qualified. The Department is known for its cutting-edge research and believes in disseminating the knowledge through publishing in highly reputed journals and patenting the research work.

Most of the students are placed in reputed companies, Government organizations, and Higher Educational Institutes in India and abroad. The alumni who are important stakeholders of the Department actively guide and provide valuable inputs. They constantly peer review the syllabus and curriculum to make students industry-ready. The Civil Engineering Department, apart from Teaching and R&D, also does an enormous amount of consultancy, which adds up to the institutional internal revenue generation and involves faculty and students in challenging field problems.

The faculty of the Department are actively involved in sponsored projects and have prestigious projects like DST, SERB, WTC to name a few. The Department takes pride in organizing sponsored Faculty Development Programs (FDPs) and workshops under initiatives such as Accelerate Vigyan-SERB-VRITIKA, E&ICT (NIT Warangal), and GIAN. The Civil Engineering Department has MoUs with highly reputed organizations like NIH Kakinada & NHAI. The Department is actively involved in basic and applied research in the field of Structural Engineering, Geotechnical Engineering, Geo-Environmental Engineering, Water Resources Engineering, Transportation Engineering, Remote Sensing & GIS, and Environmental Engineering.

Program Outcomes (POs)

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

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and civil engineering to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of solutions:** Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex civil engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary. environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1	Conduct surveys, create maps, measure, and analyse surface features and natural resources of the Earth.
PSO2	Characterize and assess materials for suitability in civil engineering projects.
PSO3	Analyse and design essential infrastructure for society while implementing optimal management practices for construction and maintenance of these facilities.
PSO4	Predict, forecast and implement measures to mitigate both natural and man-made hazards.

(Note: a maximum of 4 PSOs only)

Credit Distribution in Each Semester										
	I	II	III	IV	V	VI	VII	VIII	TOT	REQ
BSC	6	6	3	0	0	0	0	0	**15**	**≥ 15**
ESC	8	7	0	0	0	0	0	0	**15**	**≥ 15**
HSC	3	1	2	1	1	4	3	0	**15**	**≥ 15**
PCC	0	5	17	15	14	9	0	0	**60**	**≥ 60**
DEC	0	0	0	3	5	5	5	0	**18**	**≥ 18**
OEC	0	0	0	3	3	3	6	0	**15**	**≥ 15**
PRC	0	0	0	0	0	0	6	0	**6**	**≥ 06**
SLI	0	0	0	0	0	0	0	6	**6**	**≥ 06**
	17	**19**	**22**	**22**	**23**	**21**	**20**	**06**	**150**	

SCHEME OF INSTRUCTION

B.Tech. (Civil Engineering) Course Structure

Note:

- All BSC Courses must be offered within V Semester (Including).
- All ESC Courses must be offered within VI Semester (Including).
- For all courses in the HSC basket, slots are reserved in the template.
- Open electives/DAC approved Free Electives (MOOCS/NPTEL etc.) shall be offered from IV semester.
- Department electives shall be offered from IV semester.
- VIII semester is reserved for a semester-long internship or an additional courses/project at the institute.

I – Year: I – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.	MA1071	Differential and Integral Calculus	3	0	0	3	BSC
2.	PH1011	Engineering Physics	2	0	0	2	BSC
3.	CE1041	Engineering Mechanics	2	0	0	2	ESC
4.	ME1013	Engineering Drawing with CAD	2	0	2	3	ESC
5.	HS1011	English for Engineers-I	2	0	0	2	HSC
6.	EE1611	Basics of Electrical Engineering	2	0	0	2	ESC
7.	PH1012	Engineering Physics Laboratory	0	0	2	1	BSC
8.	ME1062	Fabrication Laboratory	0	0	2	1	ESC
9.		Physical Education	0	0	2	1	HSC
Total						**17**	

I – Year: II – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.	MA1081	Matrices Algebra and Differential Equations	3	0	0	3	BSC
2.	CS1011	Problem Solving through Computer Programming	3	0	0	3	ESC
3.	CY1011	Engineering Chemistry	2	0	0	2	BSC
4.	EC1511	Basics of Electronics Engineering	2	0	0	2	ESC
5.	CE2011	Strength of Materials-I	2	1	0	3	PCC
6.	CE1011	Civil Engineering Materials	1	0	0	1	PCC
7.	CS1012	Problem Solving through Computer Programming Lab	0	1	2	2	ESC
8.	CY1042	Chemistry Laboratory	0	0	2	1	BSC
9.	CE2012	Strength of Materials Laboratory	0	0	2	1	PCC
10.		Health Education	0	0	2	1	HSC
Total						**19**	

Note:

BSC: Basic Science Courses	ESC: Engineering Science Courses
PCC: Professional Major Core Courses	DEC: Professional Major Elective Courses
OEC: Open Elective Courses	HSC: Humanities and Social Science Courses
PRC: Professional Major Work	SLI: Semester Long Internship

II – Year: I – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.	MA2011	Statistics and Numerical Methods	3	0	0	3	BSC
2.	CE2021	Fluid Mechanics	2	1	0	3	PCC
3.	CE2031	Strength of Materials-II	2	1	0	3	PCC
4.	CE2041	Concrete Technology	3	0	0	3	PCC
5.	CE1021	Surveying	3	0	0	3	PCC
6.	CE1031	Engineering Geology	1	0	0	1	PCC
7.	CE2022	Fluid Mechanics Laboratory	0	0	2	1	PCC
8.	CE2042	Concrete Technology Laboratory	0	0	2	1	PCC
9.	CE1022	Surveying Laboratory	0	0	2	1	PCC
10.	CE1032	Engineering Geology Laboratory	0	0	2	1	PCC
11.	HS2011	Personality Development	1	0	0	1	HSC
12.		Yoga	0	0	2	1	HSC
Total						**22**	

II – Year: II – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.		Open Elective /DAC approved Free Electives (NPTEL, MOOCs, etc.)	3	0	0	3	OEC
2.	CEXXXX	Department Elective – I	3	0	0	3	DEC
3.	CE2051	Hydraulics and Hydraulic Machines	2	1	0	3	PCC
4.	CE2061	Transportation Engineering-I	3	0	0	3	PCC
5.	CE2071	Geotechnical Engineering-I	2	1	0	3	PCC
6.	CE2081	Environmental Engineering-I	3	0	0	3	PCC
7.	CE2052	Hydraulics and Hydraulic Machines Laboratory	0	0	2	1	PCC
8.	CE2062	Transportation Engineering Laboratory	0	0	2	1	PCC
9.	CE2072	Geotechnical Engineering Laboratory	0	0	2	1	PCC
10.		Social Service	0	0	2	1	HSC
Total						**22**	

III – Year: I – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.		Open Elective /DAC approved Free Electives (NPTEL, MOOCs, etc.)	3	0	0	3	OEC
2.	CEXXXX	Department Elective – II	2	0	0	2	DEC
3.	CEXXXX	Department Elective – III	3	0	0	3	DEC
4.	CE3011	Structural Analysis-I	2	1	0	3	PCC
5.	CE3021	Design of Concrete Structures	2	1	0	3	PCC
6.	CE2091	Remote Sensing in Civil Engineering	3	0	0	3	PCC
7.	CE3031	Environmental Engineering-II	3	0	0	3	PCC
8.	CE3022	Structural Software Laboratory	0	0	2	1	PCC
9.	CE3032	Environmental Engineering Laboratory	0	0	2	1	PCC
10.	SM3011	Introduction to Entrepreneurship	1	0	0	1	HSC
Total						**23**	

III – Year: II – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.		Open Elective /DAC approved Free Electives (NPTEL, MOOCs, etc.)	3	0	0	3	OEC
2.	CEXXXX	Department Elective– IV	3	0	0	3	DEC
3.	CEXXXX	Department Elective – V	2	0	0	2	DEC
4.	CE3041	Structural Analysis-II	2	1	0	3	PCC
5.	CE3051	Irrigation Engineering	2	1	0	3	PCC
6.	CE3061	Design of Steel Structures	2	1	0	3	PCC
7.		Liberal Arts/Creative Arts Courses – I				3	HSC
8.	SM3021	Design Thinking	1	0	0	1	HSC
Total						**21**	

IV – Year: I – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1.		Open Elective /DAC approved Free Electives (NPTEL, MOOCs, etc.)	3	0	0	3	OEC
2.		Open Elective /DAC approved Free Electives (NPTEL, MOOCs, etc.)	3	0	0	3	OEC
3.	CEXXXX	Department Elective – VI	3	0	0	3	DEC
4.	CEXXXX	Department Elective – VII	2	0	0	2	DEC
5.	CE4014	Professional Major Work	0	0	12	6	PRC
		Liberal Arts/Creative Arts Courses – II				3	HSC
Total						**20**	

IV – Year: II – Semester

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	CEXXXX	Department Elective – VIII (Optional)	3	0	0	3	DEC
2	CEXXXX	Department Elective – IX (Optional)	3	0	0	3	DEC
3	CE4024	Semester-Long Internship (SLI) / Additional Project at the institute/ Additional DEC for 6 credits	0	0	12	6	SLI
Total						**06**	

Basket – 1: Departmental Elective Courses:

Course Code	Semester	Credits	Course Title
CE1061	IV	3	Building Planning & Construction
CE2101	IV	3	Advanced Surveying
CE2111	IV	3	Green Buildings
CE2121	V	2	Transportation Engineering-II
CE3071	V	2	Environmental Geotechnics
CE3081	V	2	Prestressed Concrete
CE3091	V	3	Geotechnical Engineering-II
CE3101	V	3	Introduction to Soil Dynamics
CE3111	V	3	Environment Impact Assessment
CE3121	VI	3	Engineering Hydrology
CE3131	VI	3	Air Pollution Control
CE3141	VI	3	Ground Improvement Techniques
CE3151	VI	2	Quantity Survey & Public works
CE2131	VI	2	Introduction to Life Cycle Analysis
CE3161	VI	2	Introduction to Structural Dynamics
CE3171	VII	3	Spatial Analysis for Resource Management
CE3181	VII	3	Environmental Modelling
CE4031	VII	3	Design of Hydraulic Structures
CE3191	VII	2	Construction Technology & Project Management
CE3201	VII	2	Watershed Management
CE4041	VII	2	Design of Earthquake Resistance Structures
CE4051	VIII	3	Finite Element Methods
CE4061	VIII	3	Advanced Foundation Design
CE4071	VIII	3	Advance Mechanics of Solids
CE4081	VIII	3	Traffic Engineering
CE4091	VIII	3	Repair and Rehabilitation of Structures
CE4101	VIII	3	Solid Waste Management

Basket – 2: Open Elective Courses (offered to other departments):

Course Code	Semester	Credits	Course Title
CE2141	IV	3	Building Technology
CE3211	V	3	Construction Management
CE3221	VI	3	Environmental Management
CE3231	VII	3	Infrastructure for Sustainable Cities
CE3241	VII	3	Disaster Management

Minor/Double Major programs

1. Each engineering department should identify the list of courses for the minor & Double Major degree programmes. These identified courses will be offered to the Minor/Double Major degree students in every branch.
2. To get Minor degree in any engineering branch, a student has to earn 12 Credits (6 Core credits + 6 Elective Credits) prescribed for the programme.
3. To get Double Major degree in any engineering branch, a student has to earn 24 Credits (12 Core credits + 12 Elective Credits) prescribed for the programme.
4. The Minor & Double Major choices start from the beginning of 3rd Semester.
5. The students of Minor & Double Major courses will sit with regular students in the class.
6. There will a separate time table slots for Minor & Double Major courses identified by each department to enable the students to register for these courses. Courses other than Minor & Double Major courses will not be offered during these slots.
7. A student is permitted to do one Minor and one Double Major at max.
8. Each department will choose a CGPA cut off (based on II Sem CGPA) such that the total of Minor and Double Major students in any branch do not cross maximum of 30 seats.

Minor program Course Distribution

S. No.	Course Code	Course Title	Cat.	Credits	Offered Sem
1	CE2041	Slot – I (Concrete Technology)	PCC	03	III
2	CEXXXX	Slot – II – Department Elective - I	DEC	03	IV
3	CEXXXX	Slot – III- Department Elective -VI	DEC	03	V
4	CE2011	Slot – IV- Strength of Materials-I	PCC	03	VI
		TOTAL (6 Core credits + 6 Elective Credits)		**12**	

Double Major program Course Distribution

S. No.	Course Code	Course Title	Cat.	Credits	Offered Sem
1	CE2041	Slot – I -Concrete Technology	PCC	03	III
	CE1021	Slot – I- Surveying	PCC	03	III
2	CEXXXX	Slot – II- Department Elective – I	DEC	03	IV
	CE2011	Slot-II - Strength of Materials-I	PCC	03	IV
3	CEXXXX	Slot – III- Department Elective – VI	DEC	03	V
	CE3011	Slot-III- Structural Analysis-I	PCC	03	V
4	CEXXXX	Slot – IV- Department Elective – IV	DEC	03	VI
	CEXXXX	Slot-IV- Department Elective – IV	DEC	03	VI
		TOTAL (12 Core Credits + 12 Elective Credits)		**24**	

Detailed Syllabus

I YEAR: I - SEMESTER

BSC MA1071 DIFFERENTIAL AND INTEGRAL CALCULUS

L-T-P(C)
3-0-0 (3)

Pre-requisites: None

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

CO1	understand the concepts of limit, continuity, and differentiability
CO2	understand the concepts of partial derivative, chain rule, and total differentiation
CO3	find the maxima and minima of multivariable functions.
CO4	evaluate multiple integrals in various coordinate systems
CO5	apply the concepts of gradient, divergence, and curl to formulate engineering problems.
CO6	convert line integrals into area integrals and surface integrals into volume integrals

Syllabus:

Differential Calculus of functions of several variables: Review of Limit, continuity (sequential verification) and differentiability, Partial differentiation; Total differentiation; Euler's theorem and generalization; Change of variables- Jacobians; Maxima and minima of functions of several variables (2 and 3 variables); Lagrange's method of multipliers. (14)

Integral Calculus: Beta and Gamma integrals (including convergence); Differentiation under integral sign; Double and Triple integrals - computation of surface areas and volumes; change of variables in double and triple integrals. (14)

Vector Calculus: Scalar and vector fields; vector differentiation; level surfaces; directional derivative; gradient of a scalar field; divergence and curl of a vector field; Laplacian; Line and Surface integrals; Green's theorem in a plane; Stokes' theorem; Gauss Divergence theorem. (14)

Learning Resources:

Text Books:

1. Joel R. Hass, Maurice D. Weir, George B. Thomas, Thomas' Calculus, 12th edition, Pearson, 2010.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 2015
4. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Fifth Edition, Narosa Publishing House, 2016.

Reference Books:

1. T. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980

BSC PH1011 ENGINEERING PHYSICS

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1 Solve engineering problems using the concepts of wave and particle nature of radiant energy

CO2 Understand the use of lasers as light sources for low and high energy applications

CO3 Construct quantum mechanical model to explain the behavior of a system at microscopic level

CO4 Apply the concepts of energy harvesting and understand the mechanisms of photo-voltaic cells

CO5 Understand the nature and characterization of magnetic and nano-materials for applications

Syllabus:

UNIT- I WAVE OPTICS (7)

Interference: Superposition principle, coherence of light, methods to produce coherent light: division of amplitude and wavefront, Young's double slit and Newton's rings experiment: concept, working principle, and applications.

Diffraction: Introduction to Fresnel and Fraunhofer diffraction, Fraunhofer's single-slit diffraction, double-slit diffraction and diffraction grating (quantitative), and resolving power of a grating.

Polarization: Introduction to polarization, Types of polarization, Methods to produce polarization: Reflection, refraction, scattering, selective absorption and double refraction.

UNIT - II LASERS (5)

Basic theory of LASER, Einstein's coefficients and their relations, concept of population inversion, components of lasers, three and four level lasing systems, construction and working principle of various types of lasers: Nd-YAG, Helium-Neon and semiconductor lasers and their applications.

UNIT - III QUANTUM PHYSICS (7)

Origin of quantum theory and related experiments: Black-Body radiation and photo-electric effect. Heisenberg's uncertainty principle, de- Broglie's wave concept, wave function, and its properties, operators, Schrödinger's time-dependent and time-independent equations (Quantitative), particle in one-dimensional, infinite potential well, quantum tunneling phenomena and their applications in alpha decay, and scanning tunnelling microscopy (STM). Introduction to Quantum Technology (Q-switching, interaction of radiation with matter).

UNIT - IV PHOTOVOLTAICS (4)

Introduction to semiconductors, Solar spectrum, photovoltaic (PV) effect, materials, structure and working principle, I-V characteristics, power conversion efficiency, quantum efficiency, emerging PV technologies, and applications.

UNIT - V MAGNETIC AND NANO MATERIALS **(5)**

Magnetic Materials:

Introduction to Weiss theory of ferromagnetism, concepts of magnetic domains, spontaneous magnetization, Curie transition, hard and soft magnetic materials and their applications.

Nanomaterials:

Introduction, classification, and properties of nanomaterials, various methods of synthesizing nanomaterials: top-down (ball milling) and bottom-up (sol-gel) approaches.

Learning Resources:

Text Books:

1. A Textbook of Engineering Physics, Revised Edition, M. N. Avadhanulu, P. G. Kshirsagar, S. Chand and Company (2014).
2. Concepts of Modern Physics, 7th Edition, Beiser A., Mc. Graw Hill Publishers (2017).
3. Optics, Ajoy Ghatak, 7th Edition, Tata Mc Graw Hill (2020).
4. Lasers- Fundamentals and Applications, Ajoy Ghatak and K. Thyagarajan, 2nd Edition, Laxmi Publications (2019).

Reference Books:

1. Materials Science and Engineering: An Introduction (Tenth edition), William D. Callister, John Wiley & Sons (2018).
2. Introduction to Solid State Physics, 8th Edition, Charles Kittel, Wiley Publishers (2012).

ESC CE1041 ENGINEERING MECHANICS L-T-P (C) 2-0-0 (2)

Pre-requisites: None

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

CO1 Determine the resultant force and moment for a given system of forces

CO2 Analyze planar systems to determine the forces in members of trusses, frames

CO3 Determine friction forces in a body

CO4 Determine the centroid and second moment of area principles

CO5 Calculate the motion parameters of a body subjected to a given force system

Course Articulation Matrix:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	-	1	-		-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	3	-	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	-	-	1	-	-	-	-	-	-	-	1	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction - Specification of force vector, Formation of Force Vectors, Moment of Force – Cross product – Problems, Resultant of a general force system in space,

Equilibrium of force system- Degrees of freedom - Equilibrium Equations, Degree of Constraints – Free body diagrams.

Coplanar Force Systems - Introduction – Equilibrium equations – All systems, Problems

Coplanar Concurrent force system, Coplanar Parallel force system, Coplanar General force system – Point of action, Method of joints, Method of sections, Method of members.

Friction in rigid bodies- Friction – Coulombs laws of dry friction – Limiting friction, Problems on Wedge friction, Belt Friction-problems.

Centroid & Moment of Inertia - Centroid and M.I – Arial – Radius of Gyration, Parallel axis– Perpendicular axis theorem – Simple Problems.

Dynamics of Particles – Introduction to kinematics- Equations of rectilinear motion, D'Alembert's principle -Simple problems- Introduction to kinetics- Work and Energy.

Learning Resources:

Text Books:

1. J.L.Meriam, L.G. Kraige, “Engineering Mechanics: Statics SI version”, John Wiley &Sons, 2018.
2. Dietmar Gross, Werner Hauger, Jorg Schroder, Wolfgang A. Wall, Nimal Rajapakse, “Engineering Mechanics 1, Statics”, Springer, 2nd Edition, 2013.
3. A.K. Tayal, “Engineering Mechanics (14th Edition)”, Umesh Publications, 2010.

Reference Books:

1. Engineering Mechanics (5th Edition, In SI Units), S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati, McGraw Hill Publishers, 2017.
2. Engineering Mechanics (8th Edition), S S Bhavikatti, New Age International Private Limited, 2023
3. Engineering Mechanics, S Sengupta and Srinivas V Veeravalli P C Dumir, Universities Press (India) Private Limited, 2020

Other Suggested Readings:

1. https://nptel.ac.in/courses/122/104/122104015
2. https://nptel.ac.in/courses/112/106/112106180

ESC ME1013 ENGINEERING DRAWING WITH CAD

L-T-P (C)
2-0-2 (3)

Pre-requisites: None

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

CO1 Apply BIS standards and conventions while drawing lines, printing letters and showing dimensions.

CO2 Classify the systems of projection with respect to the observer, object, and reference planes.

CO3 Construct orthographic views of an object when its position with respect to the reference planes is defined.

CO4 Analyze the internal details of an object through sectional views.

CO5 Analyze the details of an object through the development of surfaces and the intersection of surfaces.

Syllabus:

Introduction: Significance of engineering drawing, BIS conventions of engineering drawing, selection of drawing sheet size and scale, types of lines, lettering, dimensioning, geometrical construction of polygons, and scales. Coordinate systems and reference planes.

Introduction to Orthographic projections: Principles of Orthographic projection, Orthographic projections of points in 1st and 3rd quadrants, Orthographic projections of lines, Orthographic projections of planes viz. triangle, square, rectangle, pentagon, hexagon, and circular laminae.

Orthographic Projection of Solids: Orthographic projection of right regular solids: Prisms, Pyramids, Cylinders, Cones, Cubes, and Tetrahedron.

Sections of Solids: Sectional planes, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section.

Isometric Projections: Isometric scale, Isometric projection of hexahedron, right regular prisms, pyramids, cylinders, cones and spheres. Isometric projection of combination of two simple solids.

Development of Surfaces of Solids: Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting with base on HP only. Development of lateral surfaces of their frustums and truncations. Problems related to applications of development of lateral surfaces like funnels and trays.

Introduction to Computer Aided Drafting software (AutoCAD): Draw entities, complex entities and edit entities, coordinate systems, and reference lines and planes.

Learning Resources:

Text Books:

1. Engineering Graphics, N.D. Bhatt and V.M. Panchal, Charotar Publishers, 2013.
2. AutoCAD 2017 for Engineers & Designers, Sham Tickoo, Dreamtech Press, 2016, 23rd Edition.

HSC HS1011 ENGLISH FOR ENGINEERS-I L-T-P (C) 2-0-0 (2)

Pre-requisites: None

Course Objectives:

- To develop a strong foundation in grammar
- To develop vocabulary and to write effective paragraphs and formal letters
- To improve reading comprehension and team-skills/collaborative skills
- To cultivate interpretive and critical thinking skills

Syllabus:

Module 1

Basics of Language: Tense, Concord, Error detection, Reading Comprehension

Module 2

Writing: Paragraphs, Precis writing, Formal letters, and Email etiquette

Module 3

Interpretation and Critical Thinking: Cross cultural communication, Identifying biases, Interpretation of visual data and information, and Logical reasoning

Module 4

Understanding Audience/Profiling Readers, Introduction to workplace communication, Group Contract/Team Contract, Presentation skills, and Techniques to enhance listening skills

Learning Resources:

Text Books:

1. Anderson, Marilyn, Pramod K. Nayar, and Madhucchanda Sen. *Critical Thinking*,
2. *Academic Writing and Presentation Skills*. Pearson Education, 2008.
3. Emden, Joan van. *Effective Communication for Science and Technology*. Macmillan Education UK, 2001.
4. Murphy, Raymond. Intermediate English Grammar. Cambridge University Press, 2014.
5. Narayanaswami, V. R. Strengthen Your Writing. Orient Longman Private Limited, 2005.

6. Sharma, Sangeetha and Binoth Mishra. *Communication Skills for Engineers and Scientists.* PHI, 2023

Reference Books:

1. Aarts, Bas. *Oxford Modern English Grammar*. Oxford University Press, 2011.
2. Blake, Gary. *The Elements of Technical Writing*. Pearson,2000
3. Carlisle, Joanne and Melinda S. Rice. *Improving Reading Comprehension*
4. *Research-based Principles and Practices*. York Press, 2002.
5. Carter, Ronald and Michael McCarthy. *Cambridge Grammar of English: A*
6. *Comprehensive Guide*. Cambridge University Press, 2006.
7. Carter, Ronald, Rebecca Hughes, and Michael McCarthy. *Exploring Grammar in*
8. *Context: Upper-intermediate and Advanced*. Cambridge University Press, 2000.
9. Dobelli, Rolf. *The Art of Thinking Clearly: Better Thinking, Better Decisions.* Sceptre,2013.
10. Eastwood, John. *Oxford Guide to English Grammar*. Oxford University Press, 1994.
11. Rolf, Dobelli.

Other Suggested Readings:

1. https://learnenglish.britishcouncil.org/

ESC EE1611 BASICS OF ELECTRICAL ENGINEERING

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1 Analyze DC & AC circuits and determine power & power factor.

CO2 Understand the principle and operation of transformers

CO3 Identify the type of DC machines for a given application

CO4 Identify the type of AC machines for a given application

CO5 Acquire the knowledge on electrical safety.

Syllabus:

DC Circuits: Kirchoff's voltage and current laws, superposition theorem, star delta transformations.

AC Circuits: Complex representation of impedance, phasor diagrams, power & power factor, solution of 1-phase series & parallel circuits.

Single Phase Transformers: Principle of operation of a single-phase transformer, emf equation, phasor diagram, equivalent circuit of a 1-phase transformer, voltage regulation & efficiency.

DC Machines: Principle of operation, classification, emf and torque equations, characteristics of generators and motors. Speed control methods.

AC Machines: 3-Phase induction motor- principle of operation, torque – speed characteristics of 3-phase induction motor & applications. **Single phase induction motor** - equivalent circuit - starting methods of single-phase induction motors - applications.

Electrical Safety: Electrical shock and precautions, concept of fuses, and application; concept of earthing.

Learning Resources:

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 2020, 9th Edition.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill, 2022, 7th Edition.
3. V.N.Mittle, Basic Electrical Engineering, 2nd edition, MC Graw Hill Education, 1 July 2017
4. Ravish R Singh, Basic Electrical Engineering, MC Graw Hill Education, 3rd edition, 2018.
5. R. Boylested and L. Nashelsky, "Electronics Devices and Circuits", Prentice Hall India, 2009.

Reference Books:

1. J. A. Edminister, Electric Circuit Theory, Schaum's Outline series: 5th edition, McGraw Hill, 2017.
2. D. P. Kothari & I.J. Nagrath, Basic Electrical Engineering, 4th edition, MC Graw Hill Education, 2019.

BSC PH1012 ENGINEERING PHYSICS LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the basic properties of light by performing experiments on interference, diffraction and polarization.
CO2	Acquire the experimental knowledge by performing the experiment using light-emitting diode
CO3	Understand the nature and characteristics of ferromagnetic and dielectric materials for memory device and sensor applications.
CO4	Apply the knowledge of Solar/ PV cells for choice of materials in efficient alternate
CO5	Apply the concepts of wave propagation through optical fibers and communication

List of experiments (any six experiments from the following list):

- Determination of radius of curvature of plano-convex lens using Newton's ring experiment.
- Determination of the width of narrow-slit by diffraction method
- Determination of wavelength of spectral lines of Mercury light by normal incidence method using diffraction grating
- Determination of Planck's constant using light emitting diode
- Study the B-H loop hysteresis and find the coercivity and retentivity of magnetic materials
- Studying current-voltage characteristics of a photovoltaic material using solar cell
- Determination of wavelength of diode laser using diffraction by metal scale
- Determination of dielectric constant of various dielectric materials
- Determination of numerical aperture of an optical fiber
- Determination of specific rotation of an optically active material-using Laurent's half-shade polarimeter

Syllabus:

Exposure to Virtual Lab (any two of the following):

1. B-H Loop tracer
2. Planck's Constant
3. Numerical aperture of Optical Fibre
4. Newton's ring

Learning Resources:

References:

1. Physics Laboratory Manual, 2024, Department of Physics, School of Sciences, National Institute of Technology Andhra Pradesh, Tadepalligudem.
2. Shukla R K, Srivastava A, 2011, Practical Physics, New Age International Pvt. Ltd., New Delhi.
3. Arora, CL, 2012, B.Sc. Practical Physics, S Chand and Company Ltd., New Delhi.
4. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar, S. Chand and Company (2015).
5. A Course of Experiments with He-Ne Lasers by R.S. Sirohi, New Age International (P) Ltd. (2009)

ESC ME1062 FABRICATION LABORATORY L-T-P (C) 0-0-2 (1)

Pre-requisites: None

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

CO1 Identify workshop tools and their operational capabilities

CO2 Practice on manufacturing of components using workshop trades including fitting,

CO3 carpentry, foundry and welding

CO4 Apply suitable tools for machining processes including turning, facing, thread

CO5 Practice on fabrication of simple components using PLA.

Syllabus:

Demonstration: Safety practices and precautions to be observed in the workshop.

Fitting Trade: Demonstration and practice of fitting tools, Preparation of T-Shape, Dovetail Joint.

Carpentry: Demonstration and practice of carpentry tools, Preparation of Cross Half lap joint and Mortise Tenon Joint.

Plumbing: Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for the same diameter and with reducer for different diameters.

Machine shop: Demonstration and practice on Lathe Machine, Preparation of workpieces involving Facing, Plane Turning, step turning, knurling, and parting operations.

House Wiring: Demonstration and practice on Electrical tools, wiring, and earthing, Exercises on Staircase Wiring & Godown wiring.

Power Tools: Demonstration and practice on Power tools (Bosch Power Tools) and Safety Practices.

Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

Welding Shop: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.

Learning Resources:

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019.
2. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

3. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th Edition.
2. Elements of Workshop Technology, Vol. II by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 12th Edition.
3. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
4. Technology of machine tools, Steve F. Krar, Arthur R. Gill and Peter Smid, McGraw Hill Education (India) Pt. Ltd., 2013.
5. Engineering Practices Laboratory Manual, Ramesh Babu.V., VRB Publishers Private Limited, Chennai, Revised Edition, 2013 – 2014.
6. Engineering Practices Lab Manual; T.Jeyapoovan, Vikas Pub, 2008, 4th Edition.
7. Mechanical Workshop Practice; John K.C., PHI, 2010.
8. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

Other Suggested Readings:

1. Different Trade E-Books (Fitting, Plumbing, Welding, Carpentry, Foundryman, Turner and House Wiring etc.) developed by National Instructional Media Institute, Chennai. Directorate General of Training, Ministry of Skill Development & Entrepreneurship, Govt. of India. (https://bharatskills.gov.in).

I YEAR: II – SEMESTER

BSC MA1081 MATRIX ALGEBRA AND DIFFERENTIAL EQUATIONS

L-T-P (C)
3-0-0 (3)

Pre-requisites: Differential and Integral Calculus (MA1071)

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

CO1 solve the consistent system of linear equations

CO2 apply orthogonal transformations to a quadratic form

CO3 solve higher-order linear differential equations with constant coefficients

CO4 apply the concepts in solving physical problems arising in engineering

CO5 apply Laplace transforms to solve initial value problems

Syllabus:

Matrix Theory: Linear dependence and independence of vectors; Rank of a matrix; Consistency of the system of linear equations; Eigenvalues and eigenvectors of a matrix; Caley-Hamilton theorem and its applications; Reduction to diagonal form; Reduction of a quadratic form to canonical form - orthogonal transformation; Properties of complex matrices - Hermitian, skew-Hermitian and Unitary matrices. (14)

Ordinary Differential Equations of Higher Order: Review of First-order Ordinary Differential Equations, applications of first-order order linear differential equations, Higher order linear differential equations with constant coefficients - homogeneous and non-homogeneous; Euler and Cauchy's differential equations; Method of variation of parameters; System of linear differential equations, applications in physical problems - forced oscillations. (14)

Laplace Transforms: Laplace transforms; inverse Laplace transforms; Properties of Laplace transforms; Laplace transforms of unit step function, impulse function, periodic function; Convolution theorem, solving certain initial value problems, Solving system of linear differential equations, applications (branch-specific). (14)

Learning Resources:

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 2015.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Fifth Edition, Narosa Publishing House, 2016.

Reference Books:

1. G. Strang, Linear Algebra and Its Applications, 4th Edition, Brooks/Cole India, 2006.
2. T. M. Apostol, Calculus, Volume 2 (2nd Edition), Wiley Eastern, 1980.
3. G. F. Simmons, Differential equations with applications and historical notes. CRC Press,2016.

ESC CS1011 PROBLEM SOLVING THROUGH COMPUTER PROGRAMMING

L-T-P (C)
3-0- 0 (3)

Pre-requisites: None

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

CO1 Construct solutions to problems using computer with an understanding of the components of computing systems (apply)

CO2 Construct algorithms for mathematical and scientific problems (apply),

CO3 Construct modular programs using control structures and suitable data types (apply)

CO4 Compare alternate algorithmic approaches for problem solving and construct efficient algorithms (analyze)

CO5 Construct modular programs with an understanding of efficient memory access and usage (apply)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	-	-	-	-	-	-	-	-	L
CO2	S	M	L	-	-	-	-	-	-	-	-	L
CO3	S	M	L	-	-	-	-	-	-	-	-	L
CO4	S	M	L	-	-	-	-	-	-	-	-	L
CO5	S	M	L	-	-	-	-	-	-	-	-	L

S: Strong correlation, M: Medium correlation, L: Low correlation

Syllabus:

Fundamentals of Computers, Historical perspective, Early computers, Components of a computers, Problems, Flowcharts, Memory, Variables, Values, Instructions, Programs.

Problem solving techniques – Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

Number systems and data representation, Basics of C, Basic data types. Numbers, Digit separation, Reverse order, writing in words, Development of Elementary School Arithmetic Testing System, Problems on Date and factorials,

Solutions using flow of control constructs, Conditional statements - If-else, Switch- case constructs, Loops - while, do-while, for.

Functions – Modular approach for solving real time problems, user defined functions, library functions, parameter passing - call by value, call by reference, return values, Recursion, Introduction to pointers.

Sorting and searching algorithms, Large integer arithmetic, Single and Multi- Dimensional Arrays, passing arrays as parameters to functions

Magic square and matrix operations using Pointers and Dynamic Arrays, Multidimensional Dynamic Arrays

String processing, File operations

Structures and Unions - Declaration, member variables, Problems on Complex numbers, Date, Time, Large Numbers.

Learning Resources:

Reference Books:

1. R.G. Dromey, "How to solve it by Computer", Pearson, 2008.
2. Brian W.Kernighan, Dennis Ritchie, “The C Programming Language”, 2nd edition, Person Education India, 2015
3. Behrauz, A. Forouzan, “Computer Science: A Structured Programming Approach Using C”, 3rd edition, Cengage
4. Hanly J R & Koffman E.B, “Problem Solving and Programm design in C”, 7th edition, Pearson Education
5. Randal E. Bryant, David R. O’Hallaron, “Computer Systems. A Programmer’s Perspective”, 2nd Edition, Prentice Hall
6. Ron white and Timothy Edward Downs, “How Computers work: The evolution of Technology” 10th Edition BPB Publications.

BSC CY1011 ENGINEERING CHEMISTRY

L-T-P (C)
2-0-0 (2)

Pre- Requisites: None

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

CO1 Gain foundational knowledge on how chemical principles influence the electrochemical properties of matter

CO2 Understand how basic chemical principles relate to everyday materials

CO3 Understand the electronic, and vibrational properties of materials

CO4 Analyze and solve problems associated with hardness of water and address the societal issues related to the quality of water.

Syllabus:

Chapter-I: Electrochemistry (8 hours)

Redox reactions; Electrode potential; Electrochemical cells; Electromotive force (EMF); Nernst equation; Batteries, Primary batteries: Daniel and Leclanche cell; Rechargeable batteries: lead-acid, nickel-cadmium and lithium-ion; Fuel Cells: hydrogen-oxygen and methanol-oxygen; Corrosion: dry & wet corrosion, corrosion controlling methods.

Chapter-II: Polymer Chemistry and Engineering Materials (6 hours)

Polymers: degree of polymerization, functionality, tacticity, classification, types of polymerizations & their mechanism, molecular weight of polymers, polydispersity index, Recycling of Polymers, conducting polymers and their classification; Engineering materials: organic light-emitting diode (OLED).

Chapter-III: Spectroscopy (8 hours)

Origin of spectroscopy; Electromagnetic radiation; Quantized energy levels of matter; UV-Vis spectroscopy: electronic transitions, Beer-Lambert's law, instrumentation, Woodward-Fieser rules and applications; Infrared (IR) spectroscopy: vibrational transitions, principle, influencing factors, instrumentation and applications.

Chapter-IV: Water Technology (6 hours)

Soft and hard water; Estimation of hardness by EDTA method and numerical problems; Boiler troubles; Softening of water: lime-soda process, ion-exchange process, reverse osmosis; Internal treatment of water: carbonate conditioning, phosphate conditioning, colloidal conditioning, calgon conditioning.

Text Books:

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Company.
2. Introduction to Spectroscopy by Donald L. Pavia, 5th edition, Cengage Learning India Private Limited, 2015.
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Reference books:

1. Elements of Physical Chemistry by P. W. Atkins, Oxford University Press, 2007.
2. A textbook of Polymer Chemistry by M. S. Bhatnagar, S. Chand, ISBN-13:978-8121932301.
3. Organic Spectroscopy by William Kemp, 2nd edition, Macmillan publishers, 2019.

ESC EC1511 BASICS OF ELECTRONICS ENGINEERING

L-T-P (C)
2-0-0 (2)

Pre- Requisites: None

Course Outcomes:

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

CO1 To explain the role of Electronics Engineering in other branches of engineering

CO2 To understand the basic building blocks of digital and analog electronic circuits

CO3 To Understand the behavior and operation of electronic devices

CO4 Design electronic circuits using diode, transistor ideal Op-amp, design of simple combinational and sequential circuits and realize the importance of various analog and digital electronic systems

Syllabus:

Introduction to electronics systems, Diode circuit models and applications: Introduction to circuit models, Clippers and Clampers, Zener diode.

Transistors –BJT and MOSFET: - BJT construction and operation, BJT configurations, BJT current components BJT characteristics, Transistor as an amplifier and switch, MOSFET.

Integrated Circuits: Operational amplifiers Characteristics and applications, linear operations using Opamps.

Digital Circuits: Number systems and logic gates, Combinational Logic circuits, Sequential Circuits, Analog to Digital and Digital to Analog converters (ADC/DAC).

Miscellaneous Electronic Devices: - SCR, LED, Photodiode, Laser, Solar Cells, Sensors.

Laboratory measuring instruments: principles of digital multi-meters, Cathode ray oscilloscopes (CRO).

Text Books:

1. Bhargava N. N., D C Kulshreshtha and S C Gupta, Basic Electronics & Linear Circuits, 2nd Edition, Tata McGraw Hill, 2013.
2. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press , 6th Edition
3. Leach , Malvino, Saha, Digital Principles and Applications, McGraw Hill Education , 8th Edition
4. Boylestad, Robert L., Louis Nashelsky, Electronic Devices and Circuits, Pearson , 11th Edition
5. Helfrick and Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI, 2011
6. Neil Storey, Electronics A Systems Approach, 4th Edition, Pearson Education Publishing Company Pvt Ltd.

PCC CE2011 STRENGTH OF MATERIALS -I

L-T-P (C)
2-1-0 (3)

Pre-requisites: None

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

CO1 Analyse the statically determinate and indeterminate problems

CO2 Draw shear force and bending moment diagrams for statically determinate beams.

CO3 Determine the stresses and strains in the members subjected to bending

CO4 Analyse the members subjected to torsional loading

Course Articulation Matrix:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	-	-	-	-	-	-	-	1	-	-	3	-
CO2	3	3	2	1	-	-	-	-	-	-	-	1	-	-	3	-
CO3	3	3	3	2	-	-	-	-	-	-	-	1	-	-	3	-
CO4	3	3	3	3	2	-	-	-	-	-	-	1	-	-	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Stress and Strain: Concept of static determinacy and indeterminacy- Determinate and Indeterminate problems in Tension and Compression - Thermal Stresses.

Elastic Constants: Stress-strain diagrams for brittle and ductile materials - pure shear - Modulus of rigidity and Bulk modulus - Relation between E, G and K.

Shear Force and Bending Moment: Types of supports - Types of determinate beams - Simply supported, Cantilever, Overhanging and compound beams with articulations -Shear Force and Bending Moment diagrams - Principles of Superposition.

Theory of Simple Bending: Assumptions - Theory of Simple Bending - Bending stresses in beams - Discussion of efficiency of various shapes of cross sections

Shear Stress Distribution: Flexural shear stress distribution in various shapes of cross section of beams.

Torsion of Circular Shafts: Theory of Pure Torsion in Solid and Hollow circular shafts - Torsional Shear Stresses and angle of twist - transmission of Power.

Springs: Types and classification of springs – Analysis of Close coiled helical springs

Learning Resources:

Text Books:

1. Mechanics of Materials, Timoshenko and Gere, CBS Publishers, New Delhi, 2004, 2nd Edition.
2. Strength of Materials - Fundamentals and Applications, T.D.Gunneswara Rao and Mudimby Andal, Cambridge University Press, 2018, 1st Edition
3. Mechanics of Structures Vol 1 (Strength of Material), S. B. Junarkar and H. J. Shah, Charotar Publishing House Pvt. Ltd., 2012.

Reference Books:

1. Engineering Mechanics of Solids, E.P.Popov, Pearson, 2015, 2nd Edition.
2. Mechanics of Materials, Beer and Johnston, McGraw Hill India Pvt. Ltd., 2020, 8th Edition (SI Units).
3. Strength of Materials - Pytel & Singer, Harper & Row Publishers, 2018, 4th Edition.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/10518

PCC CE1011 CIVIL ENGINEERING MATERIALS

L-T-P (C)
1-0-0 (1)

Pre-requisites: None

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

CO1 Classify and characterize building stones

CO2 Comprehend the manufacturing process of bricks

CO3 Recognize the preservation methods of timber

CO4 Identify the advanced Civil Engineering materials

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	2	-	1	2	2	3	2	3	2	1	-
CO2	2	2	2	-	-	2	2	2	2	2	2	2	-	3	1	-
CO3	1	2	1	2	1	2	2	2	2	2	2	3	2	2	1	-
CO4	2	3	2	2	3	3	2	1	2	2	3	3	-	3	1	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Building Stones: Classification of stones- Characteristics of good building stones, important types of building stones, their properties and stones and uses.

Brick and other Clay Products: Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, classification and testing of bricks, special types of bricks and their uses.

Timber and Wood Based Products: Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, ply wood and its uses.

Lime: IS classification of lime and uses.

Introduction to Advanced Materials: Ferro cement, FAL-G brick, super plasticizers, and geotextiles.

Learning Resources:

Text Books:

1. Building Materials, Duggal, S.K, New Age International (P) Limited Publishers., 2008, 3rd Edition
2. Civil Engineering Materials, Peter A. Claisse, Butterworth- Heinemann, 2016, 1st Edition.

Reference Books:

1. Essentials of Civil Engineering Materials. Kathryn E. Schulte Grahame, Steven W. Cranford, Craig
2. M. Shillaber, and Matthew J. Eckelman. Cognella Academic Publishing, San Diego, 2020, 1st Edition.
3. Building Materials in Civil Engineering, Haimei Zhang. Woodhead Publishing Limited and Science Press, 2011, 1st Edition.

Other Suggested Readings:

1. https://onlinecourses.nptel.ac.in/noc21_ar11/preview
2. https://nptel.ac.in/courses/105/102/105102088/
3. https://nptel.ac.in/courses/105/106/105106053/

ESC CS1012 PROBLEM SOLVING THROUGH COMPUTER PROGRAMMING LAB

L-T-P (C)
0-1-2 (2)

Pre-requisites: None

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

CO1 Construct, debug, test and run efficient programs by leveraging suitable flow of control constructs and syntactic units of the programming language

CO2 Construct efficient programs by constructing and translating algorithms for solving problems using sorting, searching, selection and / or arithmetic computations.

CO3 Implement, refactor, test and debug functional programs in a shell-based run time environment

CO4 Construct efficient programs by demonstrating problem-solving skills and out- of-the-box algorithmic thinking.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	-	S	-	-	-	M	-	-	L
CO2	S	M	L	-	S	-	-	-	M	-	-	L
CO3	S	M	L	-	S	-	-	-	M	-	-	L
CO4	S	M	L	-	S	-	-	-	M	-	-	L

S: Strong correlation, M: Medium correlation, L:Low correlation

Syllabus:

- Familiarization with basic C syntax and running and debugging programs in Linux environment
- Programs on conditional control constructs.
- Programs on iterative constructs. (while, do-while, for).
- Programs using user defined functions and in-built function calls
- Programs related to Recursion.
- Programs on single and multi-dimensional arrays
- Programs related to String processing and Pointers
- Programs on Structures and Unions
- Programs related to Files and I/O.
- Case study/Mini project.

Learning Resources:

Reference Books:

1. R.G. Dromey, "How to solve it by Computer", Pearson, 2008.
2. Brian W.Kernighan, Dennis Ritchie, “The C Programming Language”, 2nd edition, Person Education India, 2015
3. Behrauz, A. Forouzan, “Computer Science: A Structured Programming Approach Using C”, 3rd edition, Cengage
4. Hanly J R & Koffman E.B, “Problem Solving and Programm design in C”, 7th edition, Pearson Education
5. Randal E. Bryant, David R. O’Hallaron, “Computer Systems. A Programmer’s Perspective”, 2nd Edition, Prentice Hall
6. Ron white and Timothy Edward Downs, “How Computers work: The evolution of Technology” 10th Edition BPB Publications.

BSC CY1042 CHEMISTRY LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Select a suitable methodology and compare the strategies involved in the estimation of hardness of water for various applications.

CO2 Apply a selective instrumental method to alternate tedious and complex titration processes for repeated and regulated analysis of acids, bases, etc.

CO3 Work independently and in teams to solve problems with effective communication.

Syllabus:

- Standardization of potassium permanganate solution
- Determination of hardness of water
- Determination of the concentration of a coloured solution using the colorimetric method
- Synthesis of Bakelite
- Conductometric titration of a strong acid vs a strong base
- pH-metric titration of a strong acid vs a strong base

Reference books:

1. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney.
2. David Collins, Investigating Chemistry: Laboratory Manual, Freeman & Co., 1st Edition, 2006.

PCC CE2012 STRENGTH OF MATERIALS LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 To study the mechanical behaviour of steel used in construction practice

CO2 To determine the hardness number of material

CO3 To determine the properties of close coiled helical springs

CO4 To study the impact behaviour of the steel

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	-	-	-	-	2	-	-	-	2	-	-
CO2	3	3	-	3	3	-	-	-	-	2	-	-	-	2	-	-
CO3	3	3	-	3	-	-	-	-	-	2	-	-	-	2	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

- To study the stress-strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test on U.T.M
- To find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper by conducting hardness test.
- To determine the Modulus of rigidity by conducting Torsion test on (a) Solid shaft (b) Hollow shaft
- To find the Modulus of rigidity of the material of a spring by conducting Compression test.
- To determine the young's modulus of the material by conducting deflection test on a simply supported beam.
- To determine the Modulus of elasticity of the material by conducting deflection test on a Propped Cantilever beam.
- To determine the Modulus of elasticity of the material by conducting deflection test on a continuous beam
- Impact test for steel

Learning Resources:

Text Books:

1. Mechanics of Materials, Timoshenko and Gere, CBS Publishers, New Delhi, 2004, 2nd Edition.
2. Strength of Materials - Fundamentals and Applications, T.D.Gunneswara Rao and Mudimby Andal, Cambridge University Press, 2018, 1st Edition
3. Mechanics of Structures Vol 1 (Strength of Material), S. B. Junarkar and H. J. Shah, Charotar Publishing House Pvt. Ltd., 2012.

Reference Books:

1. Engineering Mechanics of Solids, E.P.Popov, Pearson, 2015, 2nd Edition.
2. Mechanics of Materials, Beer and Johnston, McGraw Hill India Pvt. Ltd., 2020, 8th Edition (SI Units).
3. Strength of Materials - Pytel & Singer, Harper & Row Publishers, 2018, 4th Edition.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/1058

II YEAR: I - SEMESTER

BSC MA2011 STATISTICS & NUMERICAL METHODS

L-T-P (C)
3-0-0 (3)

Pre-requisites: Differential & Integral Calculus (MA1071),
Matrix Algebra and Differential Equations (MA1081)

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

CO1 Interpret an experimental data using interpolation / curve fitting

CO2 Solve numerically algebraic/transcendental and ordinary differential equations

CO3 Provides a solid foundation about the concept of probability and its features

CO4 Provide the idea of important results used in statistical Inference

Syllabus:

Probability and Statistics: Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications. Testing of Hypothesis – Null and alternate hypothesis, level of significance and critical region - Z-test for single mean and difference of means, single proportion and difference of proportions - t-test for single mean and difference of means - F-test for comparison of variances, Chi-square test for goodness of fit - Karl Pearson coefficient of correlation, lines of regression and examples. (21)

Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi method and Newton-Raphson's method, Gauss-Seidal iteration method to solve a system of linear equations, Newton-Raphson's method to solve a system of nonlinear equations - Lagrange interpolation, Forward and backward differences, Newton's forward and backward interpolation formulae - Numerical differentiation with forward and backward differences - Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule - Taylor series method, Euler's method, modified Euler's method, 4th order Runge-Kutta method for solving first order ordinary differential equations. (21)

Learning Resources:

Text Books:

1. M. K. Jain, S. R. K.Iyengar and R. K. Jain, *Numerical methods for Scientific and Engineering Computation*, New Age International Publications, 2008.
2. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, S.Chand & Co, 2006.
3. E. Kreyszig, *Advanced Engineering Mathematics*, John Wiley and Sons, 8th Edition, 2008.
4. B. S. *Grewal, Higher Engineering Mathematics*, Khanna Publications, 2009.

Reference Books:

1. J. E. Freund,and M. Miller, M. *John E. Freund's Mathematical Statistics: With Applications*. Pearson Education India, (2004).

PCC CE2021 FLUID MECHANICS L-T-P (C) 2-1-0 (3)

Pre-requisites: None

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

CO1 Apply conservation laws to derive governing equations of fluid flows

CO2 Compute hydrostatic and hydrodynamic forces

CO3 Analyse and design simple pipe systems

CO4 Apply principles of dimensional analysis to design experiments

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	-	-	-	-	-	-	-	1	-	-	3	-
CO2	3	3	2	1	-	-	-	-	-	-	-	1	-	-	3	-
CO3	3	3	3	2	-	-	-	-	-	-	-	1	-	-	3	-
CO4	3	3	3	3	2	-	-	-	-	-	-	1	-	-	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Introduction to fluid mechanics and hydraulic engineering for Civil Engineering, Fundamental difference between a solid and a fluid, Constituent relationships for solids and fluids, Conservation principles applied in fluid mechanics.

Properties of Fluids: Density, specific weight, pressure, viscosity, compressibility, surface tension and capillarity. Variation of pressure with elevation in fluids, Pressure measurement, piezometers and manometers Hydrostatic forces exerted on submerged surfaces.

Description of fluid flow: Concept of continuum, control mass & control volume approach, Reynolds transport theorem. Steady flow and uniform flow for flows along streamlines. Concept and application of stream functions and velocity potential functions.

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

Dimensional Analysis: Basic concepts, design of experiments, identification of non-dimensional numbers and their significance, dimensional analysis methods.

Flow Measurement: Measurement of flow in pipes, orifice, mouthpiece, orifice meter and venturi meter, weirs and notches.

Laminar and Turbulent Flow: Laminar flow and turbulent flow in pipes, Navier-Stokes equations, Laminar flow between parallel plates, Laminar flow through pipes, Hazen-Poiseuille equation, creeping

flows, boundary layer flows, drag force on flat plates using boundary layer theory, head loss in flow through pipes, Darcy Weisbach equation, losses in pipe transitions, Turbulence, Reynolds turbulent stresses, Velocity distribution in turbulent flow, Pipe networks.

Learning Resources:

Text Books:

1. Fluid Mechanics, F M White, McGraw Hill Education India Private Limited, 2017, 8th Edition.
2. Introduction to Fluid Mechanics, Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Student Edition Seventh, Wiley India Edition, 2011.
3. Fluid Mechanics and Machinery, C. S. P. Ojha, P. N. Chandramouli, R. Berndtsson, Oxford University Press, 2010.

Reference Books:

1. Mechanics of Fluids, Shames, McGraw Hill Book Co., New Delhi, 1988.
2. Fluid Mechanics, Streeter V.L., Benjamin Wylie, McGraw Hill Book Co., New Delhi, 1999.
3. Introduction to Fluid Mechanics, Robert W. Fox, Alan T. McDonald, John W. Mitchell, Wiley, 2020.
4. Fluid Mechanics Through Problems, R. J. Garde, New Age International, 2006.
5. An Introduction to Fluid Mechanics, Chung Fang, Springer International Publishing, 2018.
6. IS 2065-1983(Reaffirmed 2001), Code of Practice for Water Supply in Buildings (Second Revision)

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/103/105103192
2. https://nptel.ac.in/courses/105/101/105101082
3. https://nptel.ac.in/courses/112/105/112105269
4. https://nptel.ac.in/courses/112/105/112105171

PCC CE2031 STRENGTH OF MATERIALS - II

L-T-P (C)
2-1-0 (3)

Pre-requisites: CE2011 Strength of Materials-I

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

CO1 To determine principal stresses and strains

CO2 To analyse columns and pressure vessels

CO3 Understand the concept of failure theories and determine the deflection of beams

CO4 Understand strain energy concepts for different loading conditions and application

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	1	-	1	1	-	-	-	-	3	1	1
CO2	2	3	3	2	-	1	-	1	1	-	-	-	-	3	1	1
CO3	1	3	1	1	-	1	-	1	1	-	1	-	-	3	1	1
CO4	2	3	2	3	-	1	-	1	1	-	1	-	-	3	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Principal Stresses and Strains at a Point: Analysis of Biaxial state of stress at a point - Principal Planes - Principal stresses and strains - Mohr's Circle and its application to different cases - combined bending and torsion

Thin-Walled Pressure Vessels: Thin cylinders; circumferential and longitudinal stresses; spherical pressure vessels

Columns and Struts: Direct and Bending stresses - Kernel of a section - Euler's critical load for columns with ordinary end conditions - Slenderness ratio and effective length of a column - Rankine's Formula - IS Code formula - Critical load of eccentrically loaded columns.

Failure Theories: (1) Maximum Principal Stress Theory (2) Maximum Principal Strain Theory (3) Maximum Shear Stress Theory (4) Strain Energy Theory (5) Distortion energy theory - Applications.

Deflection of Beams: Double Integration method, Moment area method, Conjugate Beam method - Calculation of Slope and deflections of statically determinate beams.

Strain Energy: Elastic strain energy for uni-axial stress; elastic strain energy in pure bending; Strain energy of beams in shear; Strain energy of circular shafts in torsion; strain energy for multiaxial state of stress; Castigliano's Theorem I - application to statically determinate beams for determining slopes and deflections.

Learning Resources:

Text Books:

1. Mechanics of Materials, Timoshenko and Gere, CBS Publishers, New Delhi, 2004, 2nd Edition.
2. Strength of Materials - Fundamentals and Applications, T.D.Gunneswara Rao and Mudimby Andal, Cambridge University Press, 2018, 1st Edition
3. Mechanics of Structures Vol 1 (Strength of Material), S. B. Junarkar and H. J. Shah, Charotar Publishing House Pvt. Ltd., 2012.

Reference Books:

1. Engineering Mechanics of Solids, E.P.Popov, Pearson, 2015, 2nd Edition.
2. Mechanics of Materials, Beer and Johnston, McGraw Hill India Pvt. Ltd., 2020, 8th Edition (SI Units).
3. Strength of Materials - Pytel & Singer, Harper & Row Publishers, 2018, 4th Edition.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105108

PCC CE2041 CONCRETE TECHNOLOGY

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Identify Quality Control tests on concrete making materials

CO2 Understand the behavior of fresh and hardened concrete

CO3 Understand the durability requirements of concrete

CO4 Design concrete mixes and understand various special concretes

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	-	-	-	2	-	2	-	-	2	-	-	3	2	-
CO2	-	3	2	--	-	2	-	2	-	-	2	-	-	2	3	-
CO3	-	-	3	2	-	2	-	2	-	-	2	-	-	2	3	-
CO4	-	3	2	3	-	2	-	2	-	-	1	-	-	2	3	2

1 - Slightly; 2 - Moderately; 3 Substantially

Syllabus:

Cement: Flow diagram of manufacturing process of cements, chemical composition of cement.

Hydration of Cement: Bogue's compounds, Hydration, Gel formation, Types of cement, pore & capillary water, Quality tests on cement: Different test on cement as per Indian standards Aggregates: Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis, Grading.

Fresh concrete: Properties of fresh concrete- Workability – different tests of workability, Factors influencing workability compaction, finishing, curing.

Hardened concrete: Tests on hardened concrete as per IS codes – Relationship between different strengths – factors influencing strength, NDT techniques.

Durability: Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack.

Concrete Mix design: Different methods of mix design – factors affecting mix design – exercises.

Special concrete: Heavy density concrete, underwater concrete, self-compacting concrete, light weight concrete etc.

Learning Resources:

Text Books:

1. Properties of Concrete, AM Nevelli, Prentice Hall Publishers, 2012, 5th Edition.

2. Concrete Technology: Theory and Practice, M. S. Shetty and A. K. Jain, S Chand Co., Publishers, 2018.

Reference Books:

1. Concrete: Structure, Properties and Materials, P. K. Mehta and Paulo K. Monteiro, Prentice- hall international series in civil engineering and engineering mechanics, 1993.

2. Concrete Technology, J.J. Brooks and A. M. Neville, Pearson, 2019, 2nd Edition.

3. Concrete Technology, A.R. Santhakumar, Oxford Higher education, 2018

4. Concrete Technology: Theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/102/105102012/

PCC CE1021 SURVEYING L-T-P (C) 3-0-0 (3)

Pre-requisites: None

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

CO1 Learn the basic principles of Surveying

CO2 Know different instruments and techniques to determine the positions on the surface of the earth

CO3 Prepare maps/plans from the collected field data

CO4 Understand the techniques for setting out curves and other layouts etc

CO5 Familiar with the basic surveying techniques to be used for a specific civil engineering project

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	3	3	3	3	1	1	1	1	-	3	-
CO2	3	2	3	3	2	2	2	1	1	2	3	2	1	-	1	-
CO3	3	1	2	1	1	3	1	1	2	3	2	2	2	2	-	2
CO4	3	3	2	2	3	2	3	3	2	3	2	2	2	-	2	-
CO5	3	2	2	3	3	3	3	3	3	2	3	2	3	-	2	1

1 - Slightly; 2 - Moderately; 3 Substantially

Syllabus:

Introduction: Surveying objectives, plane surveying principles and classification, scales, Errors and Mistakes, Types of tapes and chains, offsets, Errors and Corrections

Compass Surveying: Measurement of directions and angles, types of compass, meridians and bearings, local attraction, magnetic declination, traversing, plotting of traverse, adjustment of closing error Plane Table Surveying: Principle and instruments used in plane table surveying, working operations, methods of plane table surveying

Levelling and Contouring: Description of a point (position) on the earth's surface, instruments for leveling, principle and classification of leveling, bench marks, leveling staff, readings and booking of levels, field work, longitudinal section and cross section, plotting the profile, height (level) computations, contours, characteristics of contours, methods of contouring, interpolation, contour gradient, contour maps, calculation of areas of a closed traverse, measurements from cross sections, earth work calculations

Theodolite and Tacheometric Surveying: Principle of theodolite survey, Theodolite component parts, observations, Traversing, traverse computations, Trigonometrical Surveying, Tacheometry, principle of tacheometry, methods of tacheometry

Curve Setting: Types of curves, elements of a curve, setting out a simple curve, setting out a compound curve, checks on field work, reverse curve, transition curves, super elevation, deflection angles, transition curves, characteristics of transition curves, method of setting out a compound curve, types of vertical curves, setting out vertical curves

Advanced Surveying: Principle of EDM, Features and Functions of Total Station, GNSS – Segments, IRNSS, GAGAN

Learning Resources:

Text Books:

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2015

2. Chandra A. M., Higher Surveying, New Age International Publishers, 2015

Reference Books:

1. James, M Anderson & Edward M., Surveying Theory and Practice, Tata Mc Graw Hill, 2012

2. Charles D Ghilani, Paul R Wolf., Elementary Surveying, Prentice Hall, 2012

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/107/105107122
2. https://nptel.ac.in/courses/105/104/105104101
3. http://sl-iitr.vlabs.ac.in/sl-iitr

PCC CE1031 ENGINEERING GEOLOGY

L-T-P (C)
1-0-0 (1)

Pre-requisites: None

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

CO1 Understand weathering process and mass movement

CO2 Identify geological formations and structures for rock mass quality assessment

CO3 Identify subsurface information and groundwater potential sites through geophysical investigations

CO4 Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	-	-	-	2	2	2	2	2	2	2	2
CO2	1	2	-	2	-	-	2	-	2	2	2	2	3	3	2	2
CO3	2	2	3	3	3	2	2	2	2	2	3	3	2	2	3	3
CO4	2	2	2	2	3	2	2	1	3	2	3	2	2	2	3	3

1 - Slightly; 2 - Moderately; 3 Substantially

Syllabus:

General Geology: Branches and scope of geology, Importance of geology in Civil engineering. Earth-surface features and internal structure, weathering of rocks.

Minerology: Definition of a crystal and mineral, physical properties in mineral identification, rock forming minerals and their identification.

Petrology: Formation and classification of rocks – Igneous, Sedimentary and metamorphic rocks, their texture and structures, Engineering Properties of Rocks

Structural Geology: Geological Map, outcrop, attitude of beds, types and classifications of folds, faults, joints, unconformities.

Dams: Types of dams, Requirements of dam sites, preliminary and detailed geological investigations for a dam site. Case histories of dam failures and their causes. Geology of the major dam sites of India. Factors affecting the seepage and leakage of reservoir and the remedial measures.

Tunnels: Purpose of tunnelling, geological considerations for tunnelling, geothermal step, over break, stand up time, and logging of tunnels.

Learning Resources:

Text Books:

1. Text Book of Engineering Geology by N. Chenna Kesavulu, Mac Millan Ltd., New Delhi. 2018.

2. Engineering Geology, D Venkat Reddy, Viskas Publishing House Pvt. Ltd., 2017

Reference Books:

3. Engineering and General Geology – Parbin singh, Katson Publishers. 2013
4. Principles of Engineering Geology – K.V.G.K. Gokhale, BS Publications, Hyderabad, 2006.
5. Engineering Geology – F.G. Bell, Elsevier Publications, 2007
6. Principles of Engineering Geology and Geotechnics – D.P. Krynine, W.R. Judd, 2018

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105106

PCC CE2022 FLUID MECHANICS LABORATORY L-T-P (C) 0-0-2 (1)

Pre-requisites: None

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

CO1 Calibrate flow discharge measuring device used in pipes channels and tanks

CO2 Determine Fluid and flow properties

CO3 Characterize laminar and turbulent flows

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3	-	1	-	-	1	-	-	1	2	-	3	-
CO2	1	1	1	3	-	1	-	-	1	-	-	1	3	-	3	-
CO3	1	2	1	3	-	1	-	-	1	-	-	1	2	-	3	-

Syllabus:

- Calibration of Venturi meter; Orifice meter (Discharge measuring device in Pipes).
- Determination of Darcy's Friction factor.
- Calibration of Rectangular Notch & Triangular Notch (Discharge measuring device in Channels).
- Verification of Bernoulli's theorem experimentally.
- Determination of Metacentric Height of a floating body.
- To determine the velocity of flow at different points along the cross section in a pipe by pitot tube.
- Application of momentum equation for determination coefficient Impact of Jets on flat and curved surfaces.
- Calibration of Orifice and Mouth Piece (Discharge measuring device in Tanks).
- To determine the Reynolds Number and Classify the flow.
- Demonstration and Analysis of Water Hammer.
- To study Free and Forced Vortex Flow Apparatus.

Learning Resources:

Text Books:

1. K.L. Kumar. "Engineering Fluid Mechanics" Experiments, Eurasia Publishing House, 2014

2. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995.

Other Suggested Readings:

1. https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html
2. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/
3. https://www.vlab.co.in/participating-institute-nitk-surathkal

PCC CE2042 CONCRETE TECHNOLOGY LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Identify Quality Control tests on concrete making materials

CO2 Understand the behavior of fresh concrete

CO3 Understand the behavior of hardened concrete

CO4 Design concrete mixes as per IS code

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	-	-	1	-	-	2	2	-	-	-	-	2	-
CO2	3	3	1	-	-	1	-	-	2	2	-	-	-	-	2	-
CO3	3	3	1	-	-	1	-	-	2	2	-	-	-	-	2	-
CO4	3	3	1	-	-	1	-	-	2	2	-	-	-	-	2	-

1 - Slightly 2 - Moderately 3 – Substantially

Syllabus:

- Determination of fineness of cement
- Determination of consistency of standard cement paste.
- Determination of Initial and Final Setting times of Cement.
- Determination of Compressive Strength of Cement.
- Determination of Fineness modulus of Coarse and Fine Aggregates.
- Determination of Specific Gravity of Coarse and Fine Aggregates.
- Workability Tests: Slump Cone Test, Compaction factor test,
- Preparing, curing and test for determination of compressive strength of concrete cubes.
- Preparing, curing and test for tensile strength of concrete.
- Experiments to demonstrate the use of non-destructive test equipment.
- Mix Design: IS Code method.

Learning Resources:

Text Books:

1. Properties of Concrete, AM Nevelli, Prentice Hall Publishers, 2012, 5th Edition.
2. Concrete Technology: Theory and Practice, M. S. Shetty and A. K. Jain, S Chand Co., Publishers, 2018.

Reference Books:

1. Concrete: Structure, Properties and Materials, P. K. Mehta and Paulo K. Monteiro, Prentice- hall international series in civil engineering and engineering mechanics, 1993.
2. Concrete Technology, J.J. Brooks and A. M. Neville, Pearson, 2019, 2nd Edition.
3. Concrete Technology, A.R. Santhakumar, Oxford Higher education, 2018
4. Concrete Technology: Theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/102/105102012

PCC CE1022 SURVEYING LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Operate and use different instruments and techniques to determine the positions

CO2 Apply the techniques for setting out curves and other layouts etc.

CO3 Demonstrate advanced equipment in preparing maps

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	2	2	2	1	1	2	3	2	1	-	1	-
CO2	3	3	2	2	3	2	3	2	3	2	3	2	2	-	2	-
CO3	3	2	2	3	3	3	3	3	2	3	2	3	3	-	2	1

1 - Slightly 2 - Moderately 3 - Substantially

Syllabus:

- Measurement of a line using a chain taking offsets on both sides
- Traversing using compass.
- Measurement of horizontal angle using Theodolite by Repetition/ Reiteration method.
- Differential Levelling.
- Profile Levelling and Cross sectioning.
- Grid Contouring
- Plane table traversing
- Direct contouring using plane tabling
- Setting out simple curve using theodolite.
- Introduction to Total Station.
- Total station traversing.
- Introduction to GPS

Learning Resources:

Text Books:

1. Surveying I & II, B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Laxmi Publications, 2015
2. Higher Surveying, Chandra A. M., New Age International Publishers, 2015

Reference Books:

1. Surveying Theory and Practice, James, M Anderson & Edward M., Tata Mc Graw Hill, 2012
2. Elementary Surveying, Charles D Ghilani, Paul R Wolf., Prentice Hall, 2012

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/107/105107122
2. https://nptel.ac.in/courses/105/104/105104101
3. http://sl-iitr.vlabs.ac.in/sl-iitr

PCC CE1032 ENGINEERING GEOLOGY LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Understand weathering process and mass movement

CO2 Identify geological formations and structures for rock mass quality assessment

CO3 Identify subsurface information and groundwater potential sites through geophysical investigations

CO4 Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	-	-	-	2	2	2	2	2	2	2	2
CO2	1	2	-	2	-	-	2	-	2	2	2	2	3	3	2	2
CO3	2	2	3	3	3	2	2	2	2	2	3	3	2	2	3	3
CO4	2	2	2	2	3	2	2	1	3	2	3	2	2	2	3	3

1 - Slightly 2 - Moderately 3 - Substantially

List of Experiments:

- Introduction to Crystallography – Identification of Crystals.
- Introduction of minerals and the study of Physical properties, Identification of Quartz and feldspars.
- Identification of pyroxenes and Amphiboles and other silicates.
- Identification of important economic minerals.
- Identification of important ore deposits.
- Identification of Igneous rocks
- Identification of Sedimentary rocks
- Identification of metamorphic rocks
- Structural geology- strike and dip, completion of outcrops maps, order of superposition.

Learning Resources:

Text Books:

1. Text Book of Engineering Geology by N. Chenna Kesavulu, Mac Millan Ltd., New Delhi. 2018.
2. Engineering Geology, D Venkat Reddy, Viskas Publishing House Pvt. Ltd., 2017

Reference Books:

1. Engineering and General Geology – Parbin singh, Katson Publishers. 2013
2. Principles of Engineering Geology – K.V.G.K. Gokhale, BS Publications, Hyderabad, 2006.
3. Engineering Geology – F.G. Bell, Elsevier Publications, 2007
4. Principles of Engineering Geology and Geotechnics – D.P. Krynine, W.R. Judd, 2018

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105106

HSC HS2011 PERSONALITY DEVELOPMENT L-T-P (C) 1-0-0 (1)

Pre-requisites: None

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

CO1 Students will develop a deeper self-awareness, gaining insights into their strengths, weaknesses, values, and emotional triggers

CO2 Students will enhance their communication skills, enabling them to express themselves more clearly and engage effectively with others

CO3 Students will improve their emotional intelligence and cultivate a growth mindset, equipping them to navigate challenges with resilience and adaptability.

CO4 Students will strengthen their abilities in conflict management, adaptability, and networking, preparing them for successful interactions in personal and professional contexts.

Syllabus:

Module 1

Introduction to personality development - self assessment- SWOT - personal values statement - (punctuality, attitude, responsibility, ethics, integrity, values, and trust, and self-confidence) - imposter syndrome, communication skills (verbal and non-verbal, body language and posture, avoiding miscommunication) - techniques for persuasive communication - key principles to increase clarity of communication

Module 2

Emotional Intelligence - ways to improve emotional intelligence - application of emotional intelligence - identifying emotional triggers - Building rapport and maintaining positive interactions - Fixed and growth mindset - emotions in personal and professional relationships, strategies for effective networking - social and dining etiquette - greetings - dress code.

Learning Resources:

Reference Books:

1. Mitra, Barun K. Personality Development and Soft Skills. 2nd ed. Oxford Higher Education, 2016.
2. Sharma, Prashant. Soft Skills: Personality Development for Life Success. 3rd ed. BPB Publications, India, 2022.
3. Goleman, D. (1995). Emotional intelligence: Why it can matter more than IQ. Bantam Books.
4. Carnegie, D. (2020). How to win friends and influence people. Srishti Publishers and Distributors.
5. Khera, S. (2014). You can win: A step-by-step tool for top achievers. Bloomsbury India

II YEAR: II - SEMESTER

PCC CE2051 HYDRAULICS AND HYDRAULIC MACHINES

L-T-P (C)
2-1-0 (3)

Pre-requisites: CE2021 Fluid Mechanics-I

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

CO1 Analyse the flow profiles in open channel flow and design channels

CO2 Compute the flow profiles in channel transitions

CO3 Design the working proportions of hydraulic machines

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	-	-	-	-	-	-	-	1	-	-	3	-
CO2	3	3	3	1	-	-	-	-	-	-	-	1	-	-	3	-
CO3	3	3	3	3	2	-	-	-	-	-	-	1	-	-	3	-

1 - Slightly 2 - Moderately 3 - Substantially

Syllabus:

Flow in Open Channels: Uniform and Non-Uniform Flows in open channel, Specific energy, Critical flow, Channel transitions, Uniform flow formulae, best hydraulic sections. Steady Gradually Varied Flow: Gradually varied flow equation, Type of GVF profiles, Computation of GVF profiles.

Steady Rapidly Varied Flow: Hydraulic jump in a horizontal rectangular channel, Specific force, Computation of energy loss.

Unsteady Flow: Celerity of a gravity wave, Monoclonal rising wave, Positive and negative surges, St. Venant's equations, Method of characteristics, Hydraulic routing.

Hydraulic Machinery: Classification of hydraulic machines, Euler's equation of turbo machines, one dimensional flow analysis and velocity triangles, Pump efficiency curves, selection of pumps, Different turbines and their efficiencies.

Learning Resources:

Text Books:

1. Flow in Open Channel, Subramnaya, K., Tata McGraw Hill Publications, New Delhi, 2008.
2. Fluid Mechanics, F M White, McGraw Hill Education India Private Limited, 2017, 8th Edition.
3. Introduction to Fluid Mechanics, Robert W. Fox, Alan T. McDonald, John W. Mitchell, Wiley, 2020.

Reference Books:

1. Open Channel Hydraulics, Chow V.T., Blackburn Press, 2009.

2. Introduction to Fluid Mechanics, Robert W. Fox Ogukuo H. Orutcgardm Alan T. Mc Donald, Student Edition 7th Wiley India Edition, 2011.

3. Fluid Mechanics and Machinery, C. S. P. Ojha, P. N. Chandramouli, R. Berndtsson, Oxford University Press, 2010.

4. Fluid Mechanics Through Problems, R. J. Garde, New Age International, 2006.

5. An Introduction to Fluid Mechanics, Chung Fang, Springer International Publishing, 2018.

Other Suggested Readings:

1. https://nptel.ac.in/courses/112/105/112105218

2. https://nptel.ac.in/courses/112/105/112105287

PCC CE2061 TRANSPORTATION ENGINEERING-I

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Plan highway network.

CO2 Design highway geometrics.

CO3 Determine the characteristics of traffic flow

CO4 Characterize the pavement materials and design a bituminous mix

CO5 Analyse, design, and construct the flexible and rigid pavements

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	3	-	-	-	-	-	-	-	2	2	3	1
CO2	3	2	2	3	1	-	-	-	-	-	-	-	2	1	2	-
CO3	2	2	2	3	2	-	-	-	-	-	-	-	2	-	2	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	2	1	2	2
CO5	3	3	3	2	2	-	-	-	-	-	-	-	2	1	-	-

Syllabus:

Highway Network Planning: Introduction, role of highway transportation, classification, network patterns, planning surveys, preparation of plans, master plan, evaluation by saturation system, 20-year road development plans, determination of road lengths.

Highway Alignment and Geometric Design: Principles of highway alignment, controlling factors, engineering surveys, design controls and criteria, cross-section elements, camber, carriageway, Kerbs, road margins, formation, right of way, typical cross-sections, sight distance concepts and requirements, design of horizontal alignment, superelevation, transition curves, design of vertical alignment, gradients, and vertical curves.

Traffic Engineering Principles: Traffic characteristics; components of traffic stream: flow speed- density, measurement and analysis, q-k-v relationships, hourly design volume, concept of PCU, capacity, level of service, parking studies and road safety, types of intersections and design requirements.

Pavement Materials and Mix Design: Types of pavement structures, functions, conventional materials used in pavements, properties relevant to the pavement, blending of aggregates, grading of bitumen, bituminous mix design using Marshall method.

Design of Pavements: Stresses and layered system concepts, stress solution for one, two-, and three- layered systems, fundamental design concepts: axle types, standard and legal axle loads, ESWL, EWLF, VDF, lane distribution factors, directional distribution factor, tire pressure, contact pressure, design life; design of flexible and rigid pavement using IRC codes; stresses in rigid pavements: Westergaard's theory, stress due to curling, frictional stresses and design of rigid pavement using IRC method.

Pavement Construction: Construction of subgrade unbound and bound layers, bituminous works, and concrete pavement construction, MoRTH specifications.

Learning Resources:

Text Books:

1. Khanna, S.K., Justo C.E.G., and Veeraragavan A., Highway Engineering, Nem Chand, and Bros., Roorkee, India, 2017, Tenth Edition.
2. Kadiyali, L.R., Traffic Engineering and Transportation Planning, Khanna Publishers, 2018 Ninth Edition

Reference Books:

1. Bituminous Road Construction in India, Kandhal P.S., PHI Learning Pvt. Ltd., New Delhi.
2. Principles of Pavement Design, Yoder E.J. and M.W. Witczak., Second Edition, John Wiley.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/101/105101087/
2. https://www.youtube.com/watch?v=5zKC_aq4ypM

PCC CE2071 GEOTECHNICAL ENGINEERING-I L-T-P (C) 2-1-0 (3)

Pre-requisites: None

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

CO1 Characterize and classify soils

CO2 Identify shear strength parameters for field conditions

CO3 Compute and analyze the consolidation settlements

CO4 Understand the principles of compaction and its control

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	3	2	-	-	2	2	2	-	2	1	3	3	1
CO2	3	3	1	2	2	-	-	1	1	1	-	-	-	3	2	-
CO3	3	1	1	1	2	-	-	1	1	-	-	-	-	3	-	1
CO4	3	3	1	1	2	-	-	1	1	1	-	-	-	3	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Soil formation- Major soil deposits of India. Basic Definitions and Relationships: 3-phase soil system, Volumetric relationships, and weight -volume relationships. Determination of Index Properties: Water content, Specific gravity, Grain size distribution by sieve and hydrometer analysis, Relative density, Atterberg limits and indices. Classification of Soils: Classification of soil systems – Particle size classification, Textural classification, AASHTO classification, Unified soil classification and Indian soil classification- Field identification of soils.

Soil Water: Types of soil water, Capillarity in soils, Permeability of soils, Darcy's law, Determination of permeability of soils, Permeability of stratified soils, Field permeability determination, Seepage velocity, Absolute coefficient of permeability, Factors affecting permeability- Effective stress principle- Effective stress under different field conditions- Seepage Pressure- Quicksand condition.

Compaction of Soils: Definition a n d importance of compaction – Standard P r o c t o r compaction test, Modified compaction test- Factors affecting compaction- Influence of compaction on soil properties – Field compaction and its control, Relative compaction. Stress distribution in Soils: Importance of estimation of stresses in soils – Boussinesq's and Westergaard's theories for point loads, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal planes – Newmark's influence chart, Contact pressure distribution in sands and clays.

Consolidation: Types of compressibility – Immediate settlement – Primary consolidation and secondary consolidation – Stress history of clay, normally consolidated soil, Over consolidated soil and under consolidated soil- preconsolidation pressure and its determination- Consolidation test, Estimation of settlements -Terzaghi's 1-D consolidation theory – Coefficient of consolidation and its determination - Spring analogy.

Shear Strength: Definition and use of shear strength - Source of shear strength Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory- Measurement of shear strength, Drainage conditions -Direct shear test, Triaxial shear test, Unconfined compression test and vane shear test – Factors affecting shear strength of granular soils and cohesive soils.

Learning Resources:

Text Books:

1. Gopal Ranjan and A.S.R. Rao, "Basic and Applied Soil Mechanics (5th edition)", New Age international Ltd., 2023.
2. V.N.S. Murthy, "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CBS Publishers, New Delhi. 2003.
3. K.R.Arora, "Soil Mechanics and Foundation Engineering (7th edition)", Standard Publishers Distributors, Delhi, 2017.
4. Kaniraj S. R, Design Aids in Soil Mechanics and Foundation Engineering, McGraw Hill Education 2017(revised)

Reference Books:

1. Robert D. Holtz, William D. Kovacs and Thomas C. Sheahan "An Introduction to Geotechnical Engineering (2nd Edition)", Pearson Education, 2013.
2. R.F. Craig, "Criag's Soil Mechanics (9th edition)", CRC Press, 2020
3. Lambe, T. W., Whitman, R. V. (1979). Soil Mechanics, S.I. Version. United States: Wiley.
4. K. Terzaghi, R.B. Peck and G. Mesri, "Soil Mechanics in Engineering Practice (3rd edition)", John Wiley & Sons, New York, 1996.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/101/105101201
2. https://nptel.ac.in/courses/105/105/105105168
3. https://nptel.ac.in/courses/105/101/105101160

PCC CE2081 ENVIRONMENTAL ENGINEERING – I

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 To make the students conversant with sources of water and its demand

CO2 To understand the basic characteristics of water and its determination

CO3 Design components of water distribution systems

CO4 Design conveyance elements of water collection systems

CO5 Plan and design components of water treatment systems

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1	3	1	1	-	-	-	1	2	-	3	2
CO2	3	3	3	3	2	3	1	1	-	-	-	1	2	-	2	2
CO3	3	3	3	3	2	3	3	2	-	-	-	1	1	-	2	1
CO4	3	3	3	3	2	3	3	2	-	-	-	1	1	-	2	1
CO5	3	3	3	3	1	3	2	2	-	-	-	1	1	-	2	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Water Sources - Quality and Quantity of Water - Intake - Factors Governing Location of Intakes - Transportation of Water - Characteristics (Physical, Chemical and Biological) - Standards - Water Borne Diseases - Natural Purification of Water Sources – Types of Water Demand - Fluctuations - Design Period - Population Forecasting Methods.

Distribution System -Requirements - Methods - Layout & Design – Appurtenances - Analysis of Pipe Networks - Types of Pipes - Pipe Appurtenances - Pumps - Pumps – Types of Conduits for Water Conveyance.

Water Treatment - Unit Operation & Processes, Processes (Sedimentation, Coagulation -Flocculation, Softening, Disinfection, Adsorption, Ion Exchange, Filtration) - Disinfection - Advanced Treatment - Design Aspects - Water Conservation – Rainwater Harvesting.

Air & Noise Pollution: Air Pollution (Health Effects, Regulatory Standards, Dispersion; Stacks, Control Systems); Noise pollution: Types of Noise – Impacts - Permissible Limits - Measurement of Noise - Control Measures

Learning Resources:

Text Books:

1. Peavy H.S, Rowe, D.R., and Tchobanoglous, G., Environmental Engineering, McGraw Hill Education, 2017 1st Indian Edition

2. Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice, cGraw Hill Education, 2017,1st Edition

Reference Books:

1. S.K. Garg, Environmental Engineering (Vol. I): Water supply Engineering, Khanna Publishers, 2017, 34th Edition.
2. John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous, MWH's Water Treatment: Principles and Design, John Wiley & Sons, Inc., 2012, 3rd Edition
3. Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice, McGraw Hill Education, 2017,1st Edition.
4. Terence Mcghee,Water Supply and Sewerage, McGraw-Hill Education, 1991, 6th edition.
5. Masters, G.M., Ela W.P Introduction to Environmental Engineering and Science, Prentice Hall of India, 1994, 3rd Edition.

Other Suggested Readings:

1. http://cpheeo.gov.in/cms/manual-on-water-supply-and-treatment.php
2. http://cpheeo.gov.in/cms/manual-on-operation--and-maintenance-of-water-supply-system 2005.php
3. http://cpheeo.gov.in/cms/manual-on-storm-water-drainage-systems---2019.php
4. https://nptel.ac.in/courses/105/105/105105201
5. https://nptel.ac.in/courses/105/106/105106119

PCC CE2052 HYDRAULICS AND HYDRAULIC MACHINES LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Test the performance of pumps and turbine and select appropriate Hydraulic Machines

CO2 Determine Manning's and Chezy's coefficients for smooth and rough channels

CO3 Determine energy loss in hydraulic jump

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	3	-	1	-	-	1	-	-	1	2	-	3	-
CO2	1	2	1	3	-	1	-	-	1	-	-	1	2	-	3	-
CO3	1	2	2	3	-	1	-	-	1	-	-	1	1	-	1	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Detailed Syllabus:

- Determination of Manning's and Chazy's Coefficients for smooth and rough channels by Gradually Varied Flow method.
- Determination of Specific Energy, Critical Depth and Plot the Specific Energy Curve.
- Determination of Energy Loss in Hydraulic Jump.
- Performance Characteristics of Pumps in Series and Parallel.
- Performance Characteristics of Submergible Pumps.
- Performance Characteristics of Varying Speed Centrifugal Pumps.
- Performance Characteristics of Pelton Turbine, Francis & Kaplan Turbine.
- To study Fluid flow and Aerodynamics in Wind tunnel.

Learning Resources:

Text Books:

1. Open Channel Hydraulics, Chow V.T., Blackburn Press, 2009.
2. Introduction to Fluid Mechanics, Robert W. Fox Ogukuo H. Orutcgardm Alan T. Mc Donald, Student Edition 7th Wiley India Edition, 2011.
3. Fluid Mechanics and Machinery, C. S. P. Ojha, P. N. Chandramouli, R. Berndtsson, Oxford University Press, 2010.
4. Fluid Mechanics Through Problems, R. J. Garde, New Age International, 2006.
5. An Introduction to Fluid Mechanics, Chung Fang, Springer International Publishing, 2018.

Other Suggested Readings:

1. https://nptel.ac.in/courses/112/105/112105218/
2. https://nptel.ac.in/courses/112/105/112105287/

PCC CE2062 TRANSPORTATION ENGINEERING LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Conduct traffic studies to estimate traffic flow characteristics
CO2 Characterize the pavement materials.
CO3 Perform quality control tests on flexible pavements and flexible pavement materials.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	-	-	2	3	2	1	1	-	-	3	2
CO2	2	2	-	2	-	-	-	2	2	2	-	1	3	3	1	-
CO3	3	2	2	3	1	-	-	2	2	2	-	1	1	3	1	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Tests on Aggregate: Aggregate gradation, combined flakiness and elongation tests, specific gravity test, water absorption test, aggregate impact test, Los Angeles abrasion test, demonstration of soundness test.

Tests on Bitumen: penetration test, flash and fire point tests, ductility test, softening point test, specific gravity test, demonstration of absolute and kinematic viscosity tests, demonstration of rolling thin film oven test.

Tests on Bituminous Mixtures: bituminous mix design using Marshall stability test, stripping value of aggregates, demonstration of retained tensile strength test, demonstration of bitumen extraction.

Tests on Soil: California bearing ratio test.

Traffic Studies: Traffic volume studies for mid-block section and intersection, spot speed, headway distribution studies, parking usage.

Learning Resources:

Text Books:

1. Khanna, S.K., Justo, C.E.G. and A. Veeraragavan Highway Materials and Pavement Testing, 5th Edition, Nem Chand, and Bros, Roorkee, India, 2009.
2. Relevant IRC codes; IS Codes; ASTM Codes

Other Suggested Readings:

1. Methods of Tests for Soil - IS-2720
2. Tests for Shape & Size of Aggregates for Concrete - IS-2386 (Part-1) [1963/2021]
3. Tests for Mechanical Properties of Coarse Aggregates for Concrete - IS-2386 (Part-4) [1963/2021]
4. Paving Bitumen - IS-73 [2013]
5. Dense Bitumen Mixes - IRC-111 [2009]
6. Bitumen Emulsion (Cationic) - IS-8887 [2004]
7. Bitumen Emulsion (Anionic) - IS-3117 [2004]

PCC CE2072 GEOTECHNICAL ENGINEERING LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: None

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

CO1 Determine the index properties of soils, to classify soil types and their consistency

CO2 Evaluate the compaction characteristics and compressibility behaviors of soils

CO3 Determine the shear strength parameters of soils through different shear testing methods

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	3	-	-	-	1	-	-	-	-	1	3	-	-
CO2	3	1	-	3	-	-	-	1	-	-	-	-	1	3	-	-
CO3	1	-	-	2	-	-	-	-	2	2	-	-	1	3	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

- Specific Gravity of soil particles.
- Sieve Analysis.
- Liquid Limit, Plastic Limit & Shrinkage Limit.
- Proctor's Standard Compaction Test.
- Determination of Field Density.
- Constant Head Permeameter Test.
- Variable Head Permeameter Test.
- Unconfined Compression Test.
- Triaxial Compression Test
- Consolidation Test.

Learning Resources:

Readings:

1. IS Codes; ASTM Codes
2. Gopal Ranjan, Rao ASR (2000): Basic and applied soil mechanics – New age publication, Delhi.

Reference

Other Suggested Readings:

1. https://nptel.ac.in/courses/105101160.

Detailed Syllabus

III – Year: I – Semester

PCC CE3011 STRUCTURAL ANALYSIS -I

L-T-P (C)
2-1-0 (3)

Prerequisites: CE2011 Strength of Materials -I

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

CO1 Formulate Equilibrium and compatibility equations for structural members.

CO2 Analyze indeterminate beams and frames using force and displacement methods

CO3 Analyze indeterminate truss systems using energy methods.

CO4 Analyze structures for moving loads by applying the concepts of influence line diagram.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-
CO2	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-
CO3	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-
CO4	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-

1-Slightly 2-Moderately 3 - Substantially

Syllabus:

Method of consistent deformation: Indeterminate beams - Propped cantilever, Fixed and Continuous beams - Analysis for shear force and bending moment - Clapeyron's theorem of three moments - Slope and deflection - effect of sinking of supports.

Slope - Deflection Method: Analysis and application to continuous beams - portal frames (single bay - Single storey).

Moment-Distribution Method: Analysis of continuous beams and portal frames (single storey single bay).

Influence lines and Moving Loads for beams: Maximum bending moment and shear force diagrams for simply supported spans traversed by single point load - two concentrated loads - Uniformly distributed load, shorter and longer than the span - enveloping parabola and equivalent uniformly distributed load, determination of maximum bending moment and shear force for a system of concentrated loads on simply supported girders - focal length of a girder - counter bracing.

Indeterminate Truss system Analysis: Analysis of pin jointed frames (one degree redundancy), Forces in indeterminate pin jointed frames due to temperature variation and lack of fit;

Influence lines and Moving Loads for trusses: Influence lines for simple trusses, Muller - Breslau Principle, Influence lines for reactions, shear force at a point and bending moment at a section of beams with fixed ends and two span continuous beams.

Learning Resources:

Text Books:

1. Theory of Structures (Vol. 1), G. Pandit, S. Gupta, Rajesh Gupta, Tata McGraw Hill Pub., 2017.
2. Theory and Problems in Structural Analysis, L.S. Negi, Tata McGraw Hill Pub., 1997.
3. Mechanics of Structures Vol 1 & Vol.2, Junarkar. S. B and Shah H.J, Charotar Publishers, 2008, 32nd Edition.

Reference Books:

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

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105166/

PCC CE3021 DESIGN OF CONCRET STRUCTURES L-T-P (C) 2-1-0 (3)

Pre-requisites: CE2031 Strength of Materials -II; CE2041 Concrete Technology

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

CO1 Understand and apply the concepts of limit state design and working stress methods

CO2 Design Reinforced Concrete slabs and beams

CO3 Design the Reinforced Concrete Columns and footings

CO4 Design structures for serviceability

CO5 Design of stair case, retaining wall and water tank

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	1	-	-	-	-	-	-	-	-	-	3	-

1-Slightly 2-Moderately 3 - Substantially

Syllabus:

- Design philosophy - Working stress and limit state methods
- Design of RC beam sections for flexure and shear using limit state methods
- Design of RC beam elements - detailing, curtailment and serviceability
- Design of one-way slabs, design of two-way slabs, design of slabs for serviceability, design of continuous slab systems.
- Design of short columns under pure compression, design of short columns under compression, and uniaxial and biaxial bending
- Principles of structural design of footings, design of isolated RC footings
- Design of cantilever Retaining walls- Design of RC Circular Water tank.

Learning Resources:

Text Books:

1. Limit State Design of Reinforced Concrete Structures, B.C.Punmia, Ashok.K.Jain and Arun.K.Jain, Laxmi Pub. Pvt Ltd, 2016.
2. IS-456-2000, BIS Publication

3. Design Of Reinforced Concrete Structures, IS:456-2000, N.Krishnaraju, CBS Publications, 2019, 4th Edition.

Reference Books:

1. Reinforced Concrete Design, Devdas Menon, S. Pillai, Tata McGraw Hill Pub., 2017, 3rd Edition.
2. Reinforced Cement Concrete Structures, R. Park and T. Paulay, MISL-WILEY Series, Wiley India Pvt. Ltd, 2009.
3. Design of Reinforced Concrete Structures, N.Subramanian, Oxford Pub Pvt Ltd, 2013.
4. Reinforced Concrete Design - Unnikrishnan & Pillai, McGraw Hill Pub, 2009.

Other Suggested Readings:

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

PCC CE2091 REMOTE SENSING IN CIVIL ENGINEERING

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Analyse the energy interactions in the atmosphere and earth surface features

CO2 To understand the characteristics of various platforms and concepts of image processing techniques for visual interpretation of satellite images

CO3 Apply the remote sensing techniques for various civil engineering problems

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	-	2	-	-	2	-	-	-	-
CO2	2	1	1	3	2	2	2	1	1	3	2	2	-	-	-	-
CO3	-	1	1	2	2	-	2	2	2	2	2	2	-	-	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction to Remote Sensing: Sources of Energy, active and passive radiation, Electromagnetic spectrum, radiation laws, interaction of energy with atmosphere scattering, absorption, atmospheric windows, interaction of EMR with earth surface features- spectral signatures, stages in remote sensing. Sensors and Platforms: Orbital movement and Earth coverage. Sun-synchronous and Geosynchronous satellites, Active and passive sensors, Characteristics of satellites and sensors, Altimeter, LANDSAT, SPOT, NOAA and IRS Series. Fundamentals of Satellite Image Interpretation: Types of data products, visual interpretation techniques, basic concepts of digital image processing techniques.

Remote Sensing Applications in Civil Engineering - Landslide, Earthquake, Hydro meteorological Hazards: Flash floods, River floods, Cyclones and Drought, Environmental hazards: Forest hazards (Deforestation, Degradation and Forest fire), and Pollution (Water, air and soil), Watershed Management, Environmental studies, Land use and Land Cover mapping – Urban sprawl and Transportation Network mapping, Geology and soil mapping, Ground Water Exploration/Recharge and Discharge change detection analysis.

Learning Resources:

Text Books:

1. Lillisand T.M and Kiefer R.W, Remote Sensing and Image Interpretation, John Wiley and Sons, 2015.
2. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2011.
3. Floyd F. Sabins, Remote Sensing Principles and Interpretation, W.H. Freeman and Co. 2007.

Reference Books:

1. P.S. Roy, R.S. Dwivedi & D. Vijayan, Remote Sensing Application, ed., published by NRSC, ISRO, Hyderabad. ISBN: 978-81-909460-0-1, January 2010.
2. Paul R. Wolf: Elements of Photogrammetry, with Air Photo Interpretation and Remote Sensing, McGraw Hill International Book Company, 2000.
3. Jensen, J.R. 2000: Remote Sensing of the Environment: An Earth resource Perspective. Prentice Hall.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105108077
2. https://archive.nptel.ac.in/courses/105/104/105104100/

PCC CE3031 ENVIRONMENTAL ENGINEERING -II L-T-P (C) 3-0-0 (3)

Pre-requisites: CE2081 Environmental Engineering-I

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

CO1 Assess characteristics of wastewater and solid waste and interpret their importance

CO2 Design conveyance elements of wastewater collection systems

CO3 Plan and design components of wastewater treatment systems

CO4 Design sludge treatment and disposal systems

CO5 Plan suitable engineering systems for treatment and disposal

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	1	3	1	1	-	-	-	1	2	-	3	2
CO2	3	3	3	3	2	3	1	1	-	-	-	1	2	-	2	2
CO3	3	3	3	3	2	3	3	2	-	-	-	1	1	-	2	1
CO4	3	3	3	3	2	3	2	2	-	-	-	1	1	-	2	1
CO5	3	3	3	3	1	3	2	2	-	-	-	1	1	-	2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Quality and Quantity Perspectives of wastewater: Physical, chemical and biological characteristics of wastewater, analysis of wastewater, Importance of BOD and COD, Effluent standards, impacts of disposal

Sewers and sewer appurtenances: Wastewater Collection, Estimation of dry weather flow and storm water flow, Hydraulic design of sewers, Limiting velocities, effect of variation in flow of sewage on velocity of flow in sewers, types of sewers, design of storm water drains.

Construction of sewers: factors affecting the selection of material for sewer construction, materials for sewers, joints in sewers, shapes of sewers, maintenance, cleaning & ventilation of sewers. Sewer appurtenances.

Primary Treatment of wastewater: Preliminary & primary treatment of wastewater: screening, grit removal basins, removal of oil and grease, sedimentation, sedimentation aided with coagulation.

Secondary Treatment of wastewater: Secondary treatment of Wastewater: Principles and classification of secondary treatment, activated sludge process, trickling filters, miscellaneous methods such as oxidation ditch, oxidation ponds, aerated lagoons, rotating biological contractors, Constructed Wetlands. Disposal of

wastewater, self-purification of streams, sewage irrigation, Treatment and disposal of sludge, On-site disposal methods

Tertiary Treatment of wastewater: Tertiary wastewater treatment, necessity and principles, Industrial wastewaters and effluent treatment plants including institutional and industrial waste management.

Municipal Solid Wastes: Characteristics of MSW, Elements of solid waste management, engineered systems for solid waste management, disposal of MSW, Introduction to hazardous waste, biomedical and e-waste disposal.

Learning Resources:

Text Books:

1. Environmental Engineering, Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, McGraw Hill Education, 2017 First Indian Edition
2. Theory and Practice of Water and Wastewater Treatment, Ronald Droste and Ronald Gehr, Wiley, 2019, 2nd Edition

Reference Books:

1. Introduction to Environmental Engineering and Science, G.B. Masters, Pearson, 2013, 3rd Edition
2. Water and Wastewater Engineering: Design Principles and Practice, Mackenzie L. Davis, McGraw Hill Education, 2017,1st Edition
3. Environmental Engineering (Vol. II): Sewage Waste Disposal and Air Pollution Engineering
4. S.K. Garg (1999), Khanna Publishers, 2018, 40th Edition.
5. Waste water Engineering Treatment and Reuse, Metcalf & Eddy, McGraw Hill Education, 2017, 4th Edition
6. Integrated Solid Waste Management, Engineering Principles and Management Issues, Tchobanoglous G, Theisen H and Vigil SA, McGraw Hill Education, 2014, Indian Edition

Other Suggested Readings:

1. http://cpheeo.gov.in/cms/manual-on-storm-water-drainage-systems---2019.php
2. http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php
3. https://nptel.ac.in/courses/105/105/105105048/
4. https://nptel.ac.in/courses/105/105/105105178/
5. https://nptel.ac.in/courses/105/107/105107207/
6. https://nptel.ac.in/courses/105/103/105103205/

PCC CE3022 STRUCTURAL SOFTWARE LABORATORY L-T-P (C) 0-0-2 (1)

Pre-requisites: None

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

CO1 To carry out computer aided analysis and design of beam truss and frame structures

CO2 To carry out computer aided analysis and design of multi-storey buildings

CO3 Draw the detailing of different structural elements

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	3	-	-	-	-	-	-	-	-	-	3	1
CO2	3	2	3	3	3	-	-	-	-	-	-	-	-	-	3	1
CO3	3	2	3	3	3	-	-	-	-	-	-	-	-	-	3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

- Introduction to civil engineering software STAAD/ETABS
- Modelling, Analysis and design off determinate beam using STAAD/ETABS
- Modelling and Analysis of indeterminate beam using STAAD/ETABS
- Modelling and Analysis of Plane and space truss using STAAD/ETABs
- Modelling and Analysis of plane and space frame using STAAD/ETABS
- Analysis and Design of Reinforced Concrete multistorey building using STAAD/ETABS

Learning Resources:

Text Books:

1. Staad Pro V8i for Beginners, T S Sharma, Notion Press
2. Exploring Bentley's STAAD. Pro CONNECT, Sham Tickko, BPB Publications
3. ETABS FOR BEGINNERS: A Comprehensive Guide to Structural Analysis and Design, S.M. Abid

Reference Books:

1. Software Manuals
2. Limit State Design of Steel Structures – S. K. Duggal, TMH Education Pvt Ltd, 2014
3. IS-800-2007, BIS Publication
4. Steel Structures: Design and Practice- N. Subramanian, Oxford Pub, 2011

5. Limit State Design of Reinforced Concrete Structures, B. C. Punmia, Ashok. K. Jain and Arun.K.Jain, Laxmi Pub. Pvt Ltd, 2016.
6. IS-456-2000, BIS Publication

Other Suggested Readings:

1. https://www.youtube.com/playlist?list=PLRm334WTwCCXpTLS9cuwgm4nXzDXm-6Ye
2. https://docs.bentley.com/LiveContent/web/STAAD.Pro%20UserManualv18/en/STAAD.Pro_User_Manual_en.pdf
3. https://web.wiki.csiamerica.com/wiki/spaces/doc/pages/1245590/From+Start+to+Finish+Model+Design+and+Optimize+a+Multi-Story+Steel+Structure+using+ETABS+-+ARCHIVAL

PCC CE3032 ENVIRONMENTAL ENGINEERING LABORATORY

L-T-P (C)
0-0-2 (1)

Pre-requisites: CE2081 Environmental Engineering-I

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

CO1 Determine physical, chemical and biological characteristics of water and wastewater

CO2 Determine optimum dosage of coagulant

CO3 Determine breakpoint chlorination

CO4 Assess the quality of water and wastewater

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2	–	1	–	–	–	–	–	1	2	–	2	–
CO2	1	1	1	2	–	1	–	–	–	–	–	1	1	–	2	–
CO3	1	1	1	2	–	1	–	–	–	–	–	1	1	–	2	–
CO4	2	2	2	2	2	1	–	–	–	–	–	1	2	–	2	–

1 - Slightly; 2 - Moderately; 3 – Substantially.

Syllabus:

- Determination of pH, Conductivity, Turbidity, Acidity, Alkalinity, Chlorides, Hardness, Fluorides of Water
- Determination of Available Chlorine in bleaching powder
- Conducting Break Point Chlorination Test
- Determination of Residual Chlorine
- Determination of Dissolved Oxygen, Chemical Oxygen Demand, Biochemical Oxygen Demand;
- Conducting Jar test for determining optimum dosage of coagulant
- Determination of Total Solids, Total Dissolved Solids & Settleable Solids.
- Determination of Most Probable Number

Learning Resources:

Text Books:

1. APHA, Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington:
2. CPCB, Guide Manual: Water and Wastewater Analysis

Reference Books:

1. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002.

2. Kotaiah, B., and Kumara Swamy, N., Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007.

Other Suggested Readings:

1. https://www.vlab.co.in/

HSC SM3011 INTRODUCTION TO ENTREPRENEURSHIP

L-T-P (C)
1-0-0 (1)

Pre-requisites: None

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

CO1	Acquaint themselves with starting new ventures and introducing new products and service ideas
CO2	Explore the processes of establishing a start-up and develop strategies and methods to mobilize resources
CO3	Create venture capitalists, consultants to new firms or new business development units of larger corporates

Syllabus:

The entrepreneur's role, task, and personality- typology of entrepreneurs: entrepreneurship as a style of management

Identify problems worth solving-political economical, and social- technical analysis- opportunity recognition-business model identification-new product franchising- sponsorship and acquisition- internal & external entry strategies

Startup ecosystem and support system- role of incubators- government initiatives

Writing and pitching business plan-entrepreneurial tool-venture capital and other forms of financing-sources of external support-developing entrepreneurial marketing-competencies-maintaining competitive advantage

Learning Resources:

References:

1. B.D.Singh. *Managing Conflict and Resolution.* Excel Books.2008
2. B. R. Barringer and D. Ireland, *Entrepreneurship*, Prentice Hall,2009.
3. G. Kawasaki, L. Filby, *The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything* , Penguin,2015.
4. R. Bansal, *Connect the Dots*, Westland, 2011.
5. Ries, Eric *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses,* Crown Business, 2011.
6. S. S. Khanka, *Entrepreneurial Development*, S. Chand & Co.2006.

III – Year: II – Semester

PCC CE3041 STRUCTURAL ANALYSIS -II L-T-P (C) 2-1-0 (3)

Pre-requisites: CE3011 Structural Analysis-I

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

CO1 Analyze beams and portal frames using flexibility matrix method.

CO2 Analyze beams and portal frames using stiffness matrix method.

CO3 Analysis of arches, cables and suspension bridges

CO4 Plastic analysis of beams and portal frames

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	2	-	1	-	1	-	-	1	-	-	-	3	3
CO2	1	3	2	2	-	1	-	1	-	-	1	-	-	-	3	3
CO3	2	3	2	2	-	1	-	1	-	-	1	-	-	-	3	3
CO4	2	3	2	2	-	1	-	1	-	-	1	-	-	1	3	3

1-Slightly 2-Moderately 3 - Substantially

Syllabus:

Introduction to Matrix Methods: flexibility and stiffness influence coefficients, Order of Indeterminacy – Flexibility and stiffness Matrix- inversion

Flexibility Method: Basic principles - choice of redundants - released structure - application of fixed beams, continuous beams and frames (jointed) upto two-degree static indeterminacy, portal frames higher degree static indeterminacy- verification by computer aided analysis

Stiffness Method: Concept of stiffness method - restrained structure - applications to continuous beams and portal frames up to two degree of kinematic indeterminacy, portal frames higher degree static indeterminacy- verification by computer aided analysis

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

Two Hinged Arches: Determinations of horizontal thrust, bending moment, normal thrust and radial shear for parabolic and segmental shapes, Influence lines for two hinged arches - effect of rib shortening - temperature effects - tied arches.

Suspension Bridges: Force in loaded cable and hanging cables - length of cables for different support conditions - simple suspension bridges with three hinged and two hinged stiffening girders - bending moments and shear force diagrams, influence lines - temperature effects on cables and stiffening girders.

Plastic analysis of Structures: Idealized stress - strain curve for mild steel; Moment - Curvature relationship for flexural members; Evaluation of fully plastic moment; Shape factor; Upper and lower bound theorems; Collapse load analysis of indeterminate beams and single bay, single storied portal frames.

Learning Resources:

Text Books:

1. Indeterminate Structures, R L Jindal, S.Chand & Co. , New Delhi,
2. Basic Structural Analysis, C S Reddy, Tata McGraw Hill Publishers, 2017
3. Theory of Structures (Vol. II), G. Pandit, S. Gupta, Rajesh Gupta, Tata McGraw Hill Publishers 2017.
4. Structural Analysis, Devdas Menon, Narosa Publishers,2010

Reference Books:

1. Intermediate Structural Analysis, Chu-Kia Wang, Tata McGraw Hill Publishers, 2017.
2. Computational Structural Mechanics, Rajasekaran & Sankara Subramanian, PHI, 2003.
3. Analysis Of Structures (Theory, Design & Details Of Structures) - Vol.2, V. N. Vazirani, M. M. Ratwani, S. K. Duggal, 1994.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/105/105105109/
2. https://nptel.ac.in/courses/105105180

PCC CE3051 IRRIGATION ENGINEERING L-T-P (C) 2-1-0 (3)

Pre-requisites: CE2051 Hydraulics and Hydraulic Machines

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

CO1 To understand the basic types of irrigation, irrigation standards and crop water assessment

CO2 To understand the different aspects of design of hydraulic system

CO3 To provide knowledge on various diversion structures

CO4 To plan and design a canal irrigation system

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	2	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	3	3	1	-	-	-	3	3	-	1	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Irrigation Systems: Types of irrigation systems, Soil moisture, Irrigation water requirements, Irrigation efficiencies, Methods of application of irrigation water, Water logging – Causes and remedial measures

Canal Systems: Types of canals, Design of stable irrigation canals, Design of lined canal, Silt theories and design of canals alluvial soil, Principle of design of longitudinal section of canal

Surface and subsurface flow analysis in hydraulic structures: Hydraulic structures on permeable foundation, Seepage theories, design of impervious floor of hydraulic structures using Bligh's theory, principle of Khosla's theory.

Design of diversion head works: Types of hydraulic structures, Layout of a diversion head work, Design of vertical drop weir, Silt control in headworks

Design of Canal Structures: Canal regulators, Types of canal falls, Head regulator and cross regulator, Canal escape, Types of cross drainage works.

Storage head works: Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Modes of failure and stability analysis, Earth dams: Types of earth dams, Causes of failure of earth dams, Seepage control.

Spillways and energy dissipation systems: Types of spillways, Ogee spillway, Principles of energy dissipators

Learning Resources:

Text Books:

1. Modi P.M., Irrigation Water Resources and Hydropower Engineering, Standard Book Publishing, 2014, Ninth Edition.
2. Punmia, B. C., Lal, P. B. B., Jain, A. K., & Jain, A. K. (2019). Irrigation and water power engineering. Laxmi Publications, Ltd, 16th edition.
3. Irrigation, Water Power and Hydropower Engineering, Arora K. R., Standard Book Publishing, New Delhi, 5th Edition, 2018.

Reference Books:

1. Asawa, G. L., 1996, Irrigation Engineering, New Age International Publishing Company, New Delhi.
2. Murthy, C. S. N., 2002, Water Resources Engineering – Principles and Practice, New Age International Publishing Company, New Delhi.
3. IS 7720:1991: Criteria for Investigation, Planning and Layout for Barrages and Weirs.
4. IS 12892:1989: Safety of Barrage and Weir Structures - Guidelines.
5. S 6966 (Part 1):1989: Hydraulic Design of Barrages and Weirs - Guidelines: Part 1 Alluvial Reaches (First Revision).
6. IS 14955:2001: Guidelines for Hydraulic Model Studies of Barrages and Weirs.
7. IS 11130:1984: Criteria for Structural Design of Barrages and Weirs.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/105/105105110/
2. https://archive.nptel.ac.in/courses/126/105/126105019/

PCC CE3061 DESIGN OF STEEL STRUCTURES

L-T-P (C)
2-1-0 (3)

Pre-requisites: CE2011 Strength of Materials-I, CE2031 Strength of Materials-II

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

CO1 Design bolt and weld connections

CO2 Design tension and compression members

CO3 Design beams and beam-columns

CO4 Design column splices and column base

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	1	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	3	-	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	-	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	3	-	1	-	-	-	-	-	-	-	-	-	2	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: General, Types of Steel, Mechanical behaviour of steel, Measures of Yielding, Measures of Ductility, Types of Structures, Structural Steel Sections.

Methods of Structural design: Introduction, Design Philosophies, Working Stress method, Ultimate Strength Method, Load and Resistant factor, Limit State Method, Partial safety factor, Load combinations, Classification of Cross sections, General aspects in the design.

Design of Steel fasteners: Types of fasteners, Riveted connections, Bolted connections, Assumptions, Failure of bolted joints, Strength of bolted joints, Design examples, Design of Welded connections, Butt weld, fillet weld, Design examples.

Design of Tension Members: General, Modes of Failure of Tension member, Analysis of Tension members, Example, Design steps, Design examples, Lug angles Design.

Design of Compression Members: General, Strength of Compression members, Design Compressive strength, Example on analysis of Compression members, Design of Angle struts, Built up Columns, Design of Lacing, Design of Battens, Design of Roof members.

Design of Beams: General, Lateral Stability of Beams, Bending Strength of Beams, Plastic Section Modulus, Design Examples.

Design of Beam Columns: Behavior of members under combined loading, Modes of Failures, Design Examples.

Design of Column Splices and Column Base: Design of Column Splice, Design Examples, Design of Column Base, Slab Base, Gusseted Base, Design Examples.

Learning Resources:

Text Books:

1. Limit State Design of Steel Structures – S.K.Duggal, TMH Education Pvt Ltd, 2nd Edition, 2014
2. IS-800-2007, BIS Publication
3. Steel Structures: Design and Practice- N.Subramanian, Oxford Pub, 2011

Reference Books:

1. Design of Steel Structures – S.S. Bhavikatti, IK International Pub Pvt Ltd, 4th Edition

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/105/105105162/

HSC SM3021 DESIGN THINKING L-T-P (C) 1-0-0 (1)

Pre-requisites: None

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

CO1 Understand and apply advanced Design Thinking techniques for problem-solving.

CO2 Develop proficiency in ideation and visualization tools to structure innovative concepts, analyze biases in user and developer perspectives to enhance communication.

CO3 Implement frameworks to sustain a culture of innovation, apply Design Thinking principles to real-world challenges through exercises and case-based discussions.

Syllabus:

Listening and empathizing techniques, observation techniques, structured open-ended approaches, overcoming cognitive fixedness, behavior models, innovation heuristics, case-based discussions-exercises.

Use of diagrams and maps in design thinking, empathy map, affinity diagram, mind map, journey map-combining ideas into complex innovation concepts, storytelling and scenario planning-improvisation, scenario development, evaluation tools, frog design-prototyping, interactive workshops, case-based discussions.

Learning Resources:

Reference Books:

1. Roger Martin, The Design of Business: Why Design Thinking is the Next Competitive Advantage, Harvard Business Press, 2009.
2. Christoph Meinel, Larry Leifer, and Hasso Plattner (eds), Design Thinking: Understand – Improve– Apply, Springer, 2011.
3. Idris Mootee, Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, John Wiley & Sons, 2013.

Departmental Elective Courses

IV SEMESTER

DEC CE1061 BUILDING PLANNING & CONSTRUCTION

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Understand the factors to be considered in planning and construction of buildings

CO2 Plan a building based on the factors and principles of planning

CO3 Understand the different component parts of building and their construction practices and techniques

CO4 Understand the functional requirements to be considered for design and construction of building

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	-	-	-	2	1	-	-	3	-	-	3	-	2	-
CO2	2	-	-	-	-	2	2	-	-	3	-	-	-	-	3	-
CO3	3	-	2	-	-	-	2	-	-	-	-	-	-	2	2	-
CO4	3	-	2	-	-	-	2	-	-	-	-	-	-	2	2	-

1 – Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Functional Planning of buildings: Sustainability and concept of Green building, General aspects to consider for planning, bye-laws and regulations, Selection of site for building construction, Principles of planning, Orientation of building and its relation to outside environment

Components of Buildings: Foundation and its requirements, Soil characteristics, Construction of Foundation.

Masonry: Definitions of terms used in masonry, Materials used, Stone masonry, Brick masonry, Different bonds used for brick masonry, Permissible stress of brick masonry work.

Floors and Roofs: Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings.

Staircases: Functional requirements of a good stair, type of steps, type of stairs, planning a staircase

Service and Safety requirements of Buildings: Damp proofing, Fire protection and Thermal insulation: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction, General methods of thermal insulation and thermal insulating materials.

Learning Resources:

Text Books:

1. Building Construction, Punmia B. C., Jain A.J., and Jain A.J., Laxmi Publication, 2016, Eleventh Edition.

2. The Text book for Building Construction, Arora S. P., and Bindra S. P., Dhanpat Rai Pubications, 2010

Reference Books:

1. Building Construction, Varghese P.C., PHI Learning Pvt. Ltd., 2017, 2nd Edition.

2. National Building Code of India, Bureau of Indian Standards, 2016.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/106/105106197/

2. https://nptel.ac.in/courses/105/102/105102175/

DEC CE2101 ADVANCED SURVEYING L-T-P (C) 3-0-0 (3)

Pre-requisites: CE1021 Surveying

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

CO1 To learn the principles of Electromagnetic distance measurement, Total Station and their accuracy

CO2 To get introduced to the concept of photogrammetry in preliminary identification and map making

CO3 To know in detail the concept of remote sensing in identification of land features from space and to get introduced to different data acquisition techniques like LIDAR, RADAR etc

CO4 To get introduced to the field of geodesy, coordinate systems, Map projections, GPS, its working principle, data collection, data processing and analysis

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	-	2	-	-	2	-	-	-	-
CO2	2	1	1	3	2	2	2	1	1	3	2	2	-	-	-	-
CO3	-	1	1	2	2	-	2	2	2	2	2	2	-	-	-	-
CO4	-	2	3	3	2	3	3	3	2	3	3	2	-	-	-	-

1 – Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Electromagnetic distance measurement (EDM) – Principle of EDM Carrier waves – Types of EDM instruments – Distomat – Total Station – Principle – procedure & surveying using Total Station – precise levelling - micro-optic theodolite.

Photogrammetry – Terrestrial and Aerial Photogrammetry – Horizontal position of a point from photographic measurement – elevation of a point – Determination of focal length of the camera – determination of scale – Ground coordinates - Relief displacement – Photo interpretation.

Remote sensing – concepts – Idealized remote sensing system – characteristics – Types of remote sensing system – Remote sensing from space – Data interpretation – application of remote sensing – LIDAR – RADAR - SONAR.

Geodesy – Figure of Earth – Classification – Earth surface - Geodetic reference surfaces - Coordinate systems – Geodetic datums and elements – Map – Scale of map – projection – UTM – Map projection of India – Space Geodesy.

GNSS Basics – system overview – working principle of GNSS – Satellite ranging – calculating position – Ranging errors and its correction – GNSS surveying Methods – static, Rapid static, DGPS and Kinematic methods – visibility diagram – GAGAN - GNSS.

Learning Resources:

Text Books:

1. Duggal, S.K. Surveying Vol. II, fifth edition, Tata McGraw Hill, 2017.
2. Punmia, B.C. Surveying Vol.III, Sixteenth edition (1 December 2022),
3. Arora, K. R. Surveying Vol. III, ISBN: 9788189401276, 9788189401276, Edition: 12th, 2015.

Reference Books:

1. Satheesh Gopi. Advanced Surveying, Pearson Education, 2007.
2. Satheesh Gopi. The Global Positioning System and Surveying using GPS, Tata McGraw, 2005.

Other Suggested Readings:

1. https://onlinecourses.nptel.ac.in/noc20_ce16/
2. https://archive.nptel.ac.in/courses/105/104/105104100/

DEC CE2111 GREEN BUILDINGS

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Assimilate environmental impact of buildings

CO2 Quantify the environmental impact of buildings in terms of energy consumption.

CO3 Integrate design strategies in the construction of green buildings as well as existing buildings.

CO4 Comprehend the procedure involved in green building certification.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	2	-	-	1	3	-	-	-	-	2	2	-	3	-
CO2	-	-	3	2	-	3	3	-	-	-	-	2	1	2	3	-
CO3	-	2	3	3	-	2	3	-	-	-	-	2	3	2	3	1
CO4	-	-	3	-	-	3	3	-	-	-	-	2	1	2	3	1

1 – Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Green Buildings: History of Green Building Movement; Environmental Impact and Resource Consumption; Introduction to concept of green buildings; Benefits of Green Building and its Productivity.

Indoor Built Environment: Problem of Existing Buildings and Built Environment; Energy use in buildings; Greenhouse Gas Emissions and Indoor Air pollution; Building Water Use; Land use and consumption; Construction Materials; Construction, Operation and Demolition Waste.

Green Building Design: Passive Design Strategies: Optimum Design, Performing Insulation Solution, Ventilation; Active Strategies: Equipment, Renewable Energy; Retrofitting; Net Zero Building Design; Embodied Energy Estimation; Life Cycle Assessment Analysis.

Green Building Assessment: Green Building Organizations, Green Building Rating Tools, Green building certification procedure.

Case study on Indira Paryavaran Bhawan: Passive Strategies, Active Strategies and Renewable Energy

Learning Resources:

Text Books:

1. Green Building Technology Guide: Volume 1 - Residential, Fred Andreas, Academic Press Inc., 2020, First Edition.

2. The Idea Of Green Building, A. K. Jain, Khanna Publishers, 2014, First Edition.

3. Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional Examination, Karthik Karuppu, Notion Press, 2019, First Edition.

Reference Books:

1. Sustainable Construction: Green Building Design and Delivery, Charles Kibert, John Wiley & Sons, 2005.

2. Energetics Perspective on the Environmental and Human Impact of Buildings, Teodora Melania Soimosan and Ligia Mihaela Moga, Business Science Reference, 2020.

3. Alternative Energy Systems in Building Design, Peter Gevorkian, McGraw-Hill Education, 2009, First Edition.

Other Suggested Readings:

1. https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf

2. https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf

3. https://www.grihaindia.org/griha-ah

V SEMESTER

DEC CE2121 TRANSPORTATION ENGINEERING-II

L-T-P (C)
2-0-0 (2)

Pre-requisites: CE2061 Transportation Engineering-I

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

CO1 Identify the factors governing the design of railway infrastructure
CO2 Analyze the railway track system and signal system with the available methods
CO3 Analyze the effects of atmospheric variables on aircraft performance and fix the orientation of the runways
CO4 Prepare geometric designs of airfield infrastructure

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	2	1	2	1	1	2	2	2	2	2	3	2
CO2	3	3	3	3	3	2	2	1	1	2	2	2	2	3	3	2
CO3	3	2	3	2	2	2	3	1	1	2	2	3	3	2	3	3
CO4	3	2	3	2	3	1	3	1	1	1	2	3	3	2	3	3

1 – Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction, Permanent Way and Components: History of Indian Railways; rail gauges, permanent way – functions, requirements, sections in embankment and cutting (single/double track), coning of wheels, adzing of sleepers, Components – rails, sleepers, and ballast.

Forces, Stresses, and Resistance of tracks: forces acting on rails, stresses in different components of track, types of resistances, tractive effort of a locomotive, hauling power of a locomotive.

Geometric Design of Railway Track: horizontal alignment – horizontal curves, super-elevation, concepts of can't excess and deficiency, safe permissible speed, transition curves, vertical alignment – gradients and grade effects, string lining of curves.

Track Junctions and Signaling: turn outs, track junctions and layouts, objectives and classification of signaling, signaling systems, systems for controlling train movement, interlocking.

Introduction, Aircraft Characteristics, and Airport selection: Aircraft and Airfield characteristics – landing gear configurations, aircraft weight, engine types; wingtip vortices, airport site selection, airport classification, passenger terminal system and its components, aircraft parking type, apron layout,

Geometric and Structural Design of the Airfield Infrastructure: runway configurations, runway orientation, wind rose, estimating runway length; taxiway, exit taxiway geometry, location of exit taxiways.

Navigational Aids and Lighting Systems: radio-based systems, radar systems; lighting systems – visual aids, marking and lighting of runway and apron area, wind and landing direction indicator, airfield signage.

Learning Resources:

Text Books:

1. Satish Chandra and M. Agrawal, Railway Engineering. Second Edition, Oxford University Press, 2013.
2. Khanna, S. K., Arora, M. G., and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.
3. Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. Planning and Design of Airports, Fifth Edition, McGraw-Hill, New York, USA, 2010.

Reference Books:

1. Rangwala. Railway Engineering. Twenty Seventh Edition, Charotar Publishing House, Anand, India, 2017.
2. Mundrey, J. S. Railway Track Engineering, Fourth Edition, Tata McGraw-Hill Education Private Limites, New Delhi, 2010.
3. Hay, W. W. Railroad engineering. Vol. 1. John Wiley & Sons, 1982.
4. Rangwala. Airport Engineering. Seventeenth Edition, Charotar Publishing House, Anand, India, 2017.

Other Suggested Readings:

1. https://rdso.indianrailways.gov.in
2. https://www.faa.gov/

DEC CE3071 ENVIRONMENTAL GEOTECHNICS

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1 Consider possible susceptibility of soil properties to Environmental effects

CO2 Identify contaminant transport mechanisms in soils

CO3 Understand environmental influences on engineering properties of soil

CO4 Analyze environmental changes to soil stabilization and landfill engineering

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	-	2	2	1	-	2	2	3	2	3	-	3
CO2	1	2	2	3	-	2	2	2	-	2	2	3	2	-	2	2
CO3	1	2	2	3	2	2	-	1	-	2	2	2	-	-	2	-
CO4	1	2	-	2	2	2	-	1	2	2	3	2	2	1	1	2

1 – Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Soil-the three-phase system, Clay - the most active soil fraction, Clay-water interactions, Causes of soil deterioration, Scope and importance of environmental geotechniques

Ground Contamination: Sources of contamination, chemical diffusion in soils, practical range of flow parameters, simultaneous flow of water, current and salts through a soil, Electro kinetic phenomenon, coupled influences on chemical flow, chemical compatibility and hydraulic conductivity.

Classification of Soil and Engineering Properties of Soil due to Changing Environment: Susceptibility to environment, mineralogy, clay-organic interactions Mechanisms controlling the index properties of fine-grained soils, effect of environmental change on Engineering properties such as permeability, volume change and shear strength.

Soil Modification by Environmental Changes and Waste Containment: Stabilisation of soil by environmental changes, use of additives and their basic mechanisms, Overview on landfill liners, Siting considerations and geometry, typical cross-sections, grading and leachate removal

Learning Resources:

Text Books:

1. Abdel-Mohsen Onsy Mohamed, Evan K. Paleologos, Devendra Narain Singh and Valeria Guimarães, (2017) “Fundamentals of Geoenvironmental Engineering: Understanding Soil, Water, and Pollutant Interaction and Transport” Elsevier Science.
2. J. K. Mitchell, (1993) “Fundamentals of Soil Behaviour” John Wiley & Sons, Inc. New York.

3. T. S. R. Ayyar, (2000) "Soil Engineering in Relation to Environment" Published by LBS Centre for Science and Technology, Thiruvananthapuram.

Reference Books:

1. R. M. Koerner, (2005) "Designing with geosynthetics", Pearson Education Inc.

2. D. E. David, and R. M. Koerner, (2007) "Waste Containment Facilities" ASCE Press, Allied Pub. Pvt. Ltd.

3. A.Sridharan, "Engineering Behaviour of Fine-Grained Soils" A Fundamental Approach, IGS Annual Lecture – 1991.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/102/105102160/

DEC CE3081 PRESTRESSED CONCRETE L-T-P (C) 2-0-0 (2)

Pre-requisites: CE3021 Design of Concrete Structures

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

CO1 Understand the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing

CO2 Analyse a Pre-stressed Concrete section

CO3 Estimate losses of pre-stressing

CO4 Design pre-tensioned and post tensioned girders for flexure and shear

CO5 Design continuous pre-tensioned and post tensioned beams

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	1	-	1	-	-	1	-	-	2	1	-
CO2	-	3	1	-	-	1	-	1	-	-	1	-	-	-	3	1
CO3	1	2	3	-	-	1	-	1	-	-	1	-	-	-	2	-
CO4	-	1	3	2	-	1	-	1	-	-	1	-	-	-	3	-
CO5	-	-	2	3	-	1	-	1	-	-	1	-	-	-	3	-

1-Slightly 2-Moderately 3 - Substantially

Syllabus:

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

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

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

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

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

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

Learning Resources:

Text Books:

1. Prestressed Concrete, Krishna Raju. N, Tata Mc Graw Hill, 2018, 6th Edition.
2. Design of Prestressed concrete, Lin.T.Y and Ned H. Burns, Mc Graw Hill Pub. Co., 2010
3. Prestressed concrete, Rajagopalan, Narosa Publishing House, 2010.

Reference Books:

1. Prestressed Concrete: A Fundamental Approach, Edward G. Nawy P.E., 1999
2. Prestressed Concrete Structures, P. Dayaratnam, P Sarah, 2017, 6th Edition
3. Reinforced and Prestressed Concrete, F. K. Kong, R. H. Evans, 1987.
4. Prestressed concrete analysis and design, J.P. Annie, P. Easwary and Y.R.M. Rao, 2018.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/106/105106117/

V SEMESTER

DEC CE3091 GEOTECHNICAL ENGINEERING-II L-T-P (C) 3-0-0 (3)

Pre-requisites: None

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

CO1 Understand soil exploration methods

CO2 Analyze the stability of slopes

CO3 Determine the earth pressures on foundations and retaining structures

CO4 Calculate the bearing capacity of soils and settlements for shallow and pile foundations

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	3	-	-	-	2	2	2	-	2	-	3	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	-	-	3	2	-
CO3	2	3	-	1	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	1	-	-	-	2	-	1	-	2	-	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Soil Exploration: Introduction and different methods – Direct methods, Semi-direct and Indirect methods; Sampling in soils and rocks; Subsurface exploration program - Preparation of bore logs and preparation of exploration report.

Stability of Soil Slopes: Types of slopes – Types of slope failures – Slip circle method, Determination of centre of most critical slip circle – Taylor's stability charts and their use, Stabilisation of soil slopes

Lateral Earth Pressures: Lateral earth pressure theory, Different types of earth pressures, Rankine's active and passive earth pressures, pressure distribution diagram for lateral earth pressures against retaining walls for different conditions in cohesionless and cohesive soils, Coulomb's active and passive earth pressure theory, Culmann's graphical construction, Problems.

Shallow foundations and Bearing Capacity: Types of shallow foundations and choice, basic requirements, Significance of these foundations. Bearing capacity of foundation: Bearing capacity – Basic Definitions, Factors affecting bearing capacity, Estimation of Bearing capacity by different methods, Analytical measures – Terzaghi's and Meyerhof methods and calculations, Field measures – SPT, CPT and Plate load tests.

Settlement of foundation: Settlement analysis – Types of foundation settlement, Components of settlements - their estimation, Allowable settlement values, Effects, Causes and remedial measures of total and differential settlements.

Deep foundations – types of deep foundations, pile foundations: Classification and uses, Load carrying capacity calculations by different methods – static methods, dynamic methods, in-situ penetration tests, piles load test; Negative skin friction; under reamed pile foundations; Pile groups – Necessity, Efficiency, Group capacity and settlements.

Learning Resources:

Text Books:

1. Das, BM (2016): "Fundamentals of Geotechnical engineering" – Cengage learning, New Delhi.
2. Bowles, J.E., (2001): "Foundation Analysis and Design"- The McGraw Hill Companies, Inc., New York.
3. Gopal Ranjan and A.S.R. Rao (2016): "Basic and applied soil mechanics" – New Age International (P) Limited, Publishers, New Delhi.
4. C. Venkataramiah, (2007) "Geotechnical Engineering"- New Age International (P) Limited, Publishers, New Delhi.

Reference Books:

1. H.G. Poulos and E.H. Davies, "Pile Foundation Analysis and Design" -Series in Geotechnical Engineering.
2. K. Terzaghi, R.B. Peck and G. Mesri, (1995) "Soil Mechanics in Engineering Practice", John Wiley& Sons, New York.
3. IS 1892-Code of Practice for subsurface investigations on foundations.
4. IS 6403-Code of Practice for determination of bearing capacity of shallow foundations.
5. IS 8009-1&2- Code of Practice for calculation of settlements of foundations Part 1 and Part 2.
6. Swami Saran (2010) "Analysis and Design of Substructure (Limit State Design)" Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
7. C.R.I. Clayton, R.I. Woods, A.J. Bond and J. Milititsky, (2014) "Earth pressure and Earth-Retaining Structures" by CRC press, London.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/101/105101216/

DEC CE3101 INTRODUCTION TO SOIL DYNAMICS

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Apply theory of vibrations to solve dynamic soil problems

CO2 Calculate the dynamic properties of soils using laboratory and field tests

CO3 Field tests for determining the dynamic properties of the soil

CO4 Analyze liquefaction susceptibility of a site and determine factor of safety against liquefaction

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	3	1	-	1	2	2	2	-	2	1	3	1	1
CO2	3	3	1	2	2	-	-	1	1	1	-	-	-	3	2	-
CO3	2	3	1	1	1	-	-	1	1	-	-	-	-	3	-	2
CO4	3	3	1	1	2	-	-	1	1	1	-	-	-	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Scope and objective; Nature and types of dynamic loading; Importance of soil dynamics

Vibration theory: Vibration of elementary systems; Degrees of freedom (SDOF and MDOF systems); Equation of motion for SDOF system; Types of vibrations; Earthquake excitation; Undamped and damped free vibrations; Torsional vibration; Critical damping; Decay of motion; Undamped and damped forced vibration; Constant force and rotating mass oscillators; Dynamic magnification factor; Transmissibility ratio; Non-harmonic, arbitrary, impact and other types of forced vibrations; Duhamel's integral; Taxing of vehicles on uneven roads; Vibration isolation; Vibration measuring instruments; Equation of motion for MDOF system.

Wave Propagation: Longitudinal and torsional waves in infinitely long rod; Solution for one-dimensional and three-dimensional equations of motion; Waves in semi-infinite body; Waves in layered medium; Earthquake waves – P-wave, S-wave, Rayleigh wave and Love wave; Locating earthquake's epicenter.

Dynamic Soil Properties: Stresses in soil element; Determination of dynamic soil properties; Field tests; Laboratory tests; Model tests; Stress-strain behavior of cyclically loaded soils; Estimation of shear modulus; Modulus reduction curve; Damping ratio; Linear, equivalent-linear and non-linear models; Ranges and applications of dynamic soil tests; Cyclic plate load test; Liquefaction; Screening and estimation of liquefaction; Simplified procedure for liquefaction estimation; Factor of safety; Cyclic stress ratio; Cyclic resistance ratio; CRR correlations with SPT, CPT, SASW test values.

Learning Resources:

Text Books:

1. Shamsher Prakash, “Soil Dynamics”, McGraw-Hill Book Company.
2. Braja. M. Das, “Principles of Soil Dynamics”, PWS-KENT Publishing Company.
3. Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall Inc.
4. Saran, S. “Soil dynamics and machine foundations”. Galhotia Publication.

Reference Books:

1. D. D. Barkan, “Dynamics of Bases and Foundations”, McGraw-Hill Book Company.
2. E. E. Richart et al. “Vibrations of Soils and Foundations”, Prentice Hall Inc.
3. Tien Hsing Wu, “Soil Dynamics”, Allyn and Bacon Inc.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105101005

DEC CE3111 ENVIRONMENTAL IMPACT ASSESSMENT

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Identify environmental attributes to be considered for the EIA study
CO2 Formulate objectives of the EIA studies
CO3 Identify the methodology to prepare rapid EIA
CO4 Prepare EIA reports and environmental management plans

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2	2	2	2	1	2	2	-	-	1	-	-	-
CO2	1	2	2	1	2	2	2	2	2	1	-	-	-	-	2	-
CO3	1	2	2	1	2	1	2	2	1	-	-	1	-	-	1	1
CO4	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

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

Identifying the Key Issues: Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues.

EIA Methodologies: Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods, Environmental index using factor analysis, Cost/benefit analysis, Predictive or Simulation methods. Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.

Reviewing the EIA Report: Scope, Baseline Conditions, Site and Process alternatives, Public hearing. Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Impact on Transport System, Integrated Impact Assessment.

Case Studies: Preparation of EIA for major developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Highways, Construction industry, pharmaceutical industry,

thermal power plant, nuclear fuel complex, Sewage treatment plants, Municipal Solid waste processing plants, Tannery industry

Learning Resources:

Text Books:

1. Environmental Impact Assessment Methodologies, Anjaneyulu.Y., and Manickam. V., B.S.
2. Publications, Hyderabad, 2007.Environmental Impact Analysis, Jain, R.K., Urban, L.V., Stracy, G.S., Van Nostrand Reinhold Co., New York, 1991

Reference Books:

1. Environmental Impact Assessment, Barthwal, R. R., New Age International Publishers, 2002
2. Environmental Impact Assessment, Rau, J.G. and Wooten, D.C., McGraw Hill Pub. Co., New York, 1996.
3. Environmental Impact Assessment-Theory and Practice, Wathern.P., Routledge Publishers, London, 2004

Other Suggested Readings:

1. Environmental Impact Assessment – Swayam Course

VI SEMESTER

DEC CE3121 ENGINEERING HYDROLOGY L-T-P (C) 3-0-0 (3)

Pre-requisites: None

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

CO1 Analyze hydro-meteorological data

CO2 Estimate abstractions from precipitation

CO3 Compute yield from surface and subsurface basin

CO4 Formulate and solve hydrologic flood routing models

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	3	2	-	-	-	-	-	-	1	3	-	1	2
CO2	2	3	1	2	2	-	-	-	-	-	-	1	3	-	1	-
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	-	3	-
CO4	3	3	2	2	3	-	-	-	-	-	-	1	1	-	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Description of Hydrologic Cycle, Overview of application of hydrology in engineering, Forms and types of precipitation, basic concepts of weather systems, characteristics of precipitation in India.

Precipitation: Measurement of precipitation, types of rain gauges, rain gauge network, collection and presentation of rainfall data, Test for consistency and continuity of data, analysis of rainfall data, average precipitation over an area, intensity-duration-frequency analysis, and depth-area-duration analysis.

Abstractions from Precipitation: Evaporation and Evaporation Process, measurement, estimation and control of evaporation, Evapotranspiration: measurement and estimation of evapotranspiration (description only), interception and depression storage, Infiltration process, measurement of infiltration, Horton's infiltration model and infiltration indices and effective rainfall.

Stream Flow Measurement: Methods of measurement of stream flow, stage- discharge relationship, Runoff characteristics, catchment characteristics effecting the runoff, yield from a catchment, flow duration curve and flow mass curve.

Hydrograph Theory: Components of hydrograph, base flow separation, direct runoff hydrograph, Unit hydrograph theory, derivation of unit hydrograph, S- hydrograph, synthetic unit hydrograph and its derivation**.**

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

Flood Routing: Concepts of flow routing, hydraulic and hydrologic routing, Reservoir routing, Muskingum channel routing.

Learning Resources:

Text Books:

1. Subrahmanya, K., 2024, sixth edition, Engineering Hydrology, Tata Mc Graw Hill Pub. Co., New Delhi.

2. Chow, V. T., Maidment and Mays, L. A., 2010, Applied Hydrology, Tata Mc Graw Hill Pub.Co., New York.

Reference Books:

1. Viesmann W and Lewis G Lt (2008) “Introduction to Hydrology”. Prentice Hall of India.

2. Ojha CSP, R. Berndstsson and P Bhunya (2008), Engineering Hydrology, Oxford University Press Co., New Delhi.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/103/105103213/.

2. https://archive.nptel.ac.in/courses/105/101/105101002/

DEC CE3131 AIR POLLUTION CONTROL L-T-P (C) 3-0-0 (3)

Pre-requisites: None

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

CO1 Identify sampling and analysis techniques for air quality assessment

CO2 Describe the plume behaviour for atmospheric stability conditions

CO3 Apply plume dispersion modelling and assess the concentrations

CO4 Design air pollution controlling devices

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	3	2	–	–	–	–	–	2	–	–	2
CO2	2	3	2	3	2	3	2	–	–	–	–	–	2	–	–	2
CO3	3	3	3	3	3	3	2	–	–	–	–	–	2	–	–	2
CO4	2	3	3	3	3	3	2	–	–	–	–	–	2	–	–	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Air Pollution: Definition - Sources & Classification of Air Pollutants - Effects of air pollution on humans, plants and materials- Global effects - Air Quality and NAAQS - National Clean air Programme- Sampling of Pollutants in ambient air - Stack sampling

Meteorology and Air Pollution: Factors influencing air pollution, Wind rose, Mixing Depths, Lapse rates and dispersion - Atmospheric stability, Plume rise and dispersion, Prediction of air quality, Box model - Gaussian model - Dispersion coefficient - Application of tall chimney for Pollutant dispersion.

Control of Particulate Pollutants: Properties of particulate pollution - Particle size distribution - Control mechanism - Dust removal equipment - Design and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters & ESP.

Control of Gaseous Pollutants: Process and equipment for the removal by chemical methods - Design and operation of absorption and adsorption equipment - Combustion and condensation equipment.

Learning Resources:

Text Books:

1. Khare M, Sharma P, Kota, S.H, Sumanth C, Air Pollution Science Engineering and Management Fundamentals, ISBN 9780367750527, CRC Press, 2024.

2. Noel, D. N., Air Pollution Control Engineering, ISBN 978-0070393677, Tata McGraw Hill Publishers, 1999.

Reference Books:

1. Colls, J., Abhishek T, Air Pollution: Measurement, Modeling and Mitigation, ISBN13: 978-0- 415-47932- 5 CRC Press, 2009.

2. Boubel, R.W., Fox, D.L., Turner, D.B. and Stern, A.C., Fundamentals of air pollution, Third Edition, ISBN 978-0-08-050707-1, Academic Press, New York, 1994

Other Suggested Readings:

1. https://nptel.ac.in/courses/105102089

2. https://indair-neeri.res.in/

DEC CE3141 GROUND IMPROVEMENT TECHNIQUES

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Identify ground conditions and suggest method of improvement

CO2 Design and assess the degree of improvement

CO3 Understand the principles of soil reinforcement and confinement in engineering constructions

CO4 Design reinforced soil structures

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	1	1	-	-	1	1	-	1	3	1	1	2
CO2	3	2	3	1	-	1	1	-	-	-	-	-	-	1	3	1
CO3	2	2	-	-	2	-	1	-	-	-	-	-	-	3	-	-
CO4	3	2	3	1	-	1	1	-	-	-	-	-	-	2	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques – suitability and feasibility.

Mechanical Modification: Principles of Mechanical Modifications - Methods of compaction, Shallow compaction, Deep compaction techniques – Vibro-floatation, Blasting, Dynamic consolidation, precompression and compaction piles.

Hydraulic Modification: Methods of dewatering – open sumps and ditches, Well-point system, Electro-osmosis, Vacuum dewatering wells; pre-loading with sand drains - strip drains, Design of vertical drains.

Physical and chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting – materials and methods.

Reinforced Earth Technology: Concept of soil reinforcement, Reinforcing materials, Backfill criteria, Design of reinforcement for internal stability, Applications of Reinforced earth structures.

Ground Anchors and Soil Nailing: Types of ground anchors and their suitability, Uplift capacity of anchors; Soil nailing and Applications.

Soil Confinement Systems: Concept of confinement, Gabion walls, Crib walls, Sand bags, Evergreen systems and fabric form work.

Geotextiles: Overview on Geosynthetics – Geotextiles, Functions and Applications.

Learning Resources:

Text Books:

1. Manfred R. Haussmann (2008) - "Engineering principles of ground modification" Pearson Education Inc. New Delhi.
2. Bell, F.G. (2006) – "Engineering Treatment of Soils" E& FN Spon, New York.
3. Purushothama Raj, P (2006)- "Ground Improvement Techniques" Laxmi Publications (P) Limited.

Reference Books:

1. Han, J (2015) – "Principles and practice of ground improvement", Wiley.
2. Kirsch, K. and Bell, A (2013) – "Ground Improvement", CRC Press.
3. Koerner, R.M. (2012) – "Designing with geosynthetics", Pearson Education Inc.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/101/105101216/

DEC CE3151 QUANTITY SURVEY AND PUBLIC WORKS

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1 Prepare quantity estimates for buildings, roads, rails and canal works

CO2 Calculate the quantity of materials required for civil engineering works as per specifications

CO3 Evaluate contracts and tenders in construction practices

CO4 Prepare cost estimates

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	3	-	-	-	-	3	1	3	3	3	-	2	-
CO2	-	2	-	-	3	-	-	-	3	1	3	3	-	-	3	-
CO3	-	3	-	-	-	-	-	-	2	2	2	1	-	2	2	2
CO4	-	3	-	-	3	-	-	-	2	2	2	3	-	2	2	3

1-Slightly 2-Moderately 3 – Substantially

Syllabus:

Introduction to estimates: Purpose of estimating; Different types of estimates - their function and preparation; Building estimates: Schedule of rates, Units of measurements, units of works; Road Estimates Volume of earthwork, Different methods, Earthwork for hill roads; Railway and canal works Estimates for a new track railway line; earthwork in canals.

Analysis of rates: Preparation for analysis of rates. Quantity of materials per unit rate of work, labour estimate.

Specifications: Necessity, types of specifications, specifications for different civil engineering materials.

Contracts: Essentials of contracts, types of engineering contracts advantages and disadvantages.

Tenders: tender forms, tender documents & notices time limits, necessity.

Valuation: Purpose, difference between value and cost, qualifications and functions of a valuer, scrap & salvage value, sinking fund, capitalized value.

Learning Resources:

Text Books:

1. Estimating Costing Specification & Valuation in Civil Engineering, M Chakraborti, National Halftone Co. Calcutta, 2006.

2. Estimating and Costing in Civil Engineering, B. N. Dutta, CBS Publishers & Distributors Private Limited, 2020.

Reference Books:

1. A Text Book of Estimating and Costing for Civil Engineering, G.S. Birdie, Dhanpat Rai Publishing Company Private Limited, 2014.

2. A Textbook of Estimating and Costing (Civil), D. D. Kohli, R. C. Kohli, S Chand Publishing, 2013.

3. Estimating, Costing and Valuation, Rangwala, Charotar Publishing House Pvt. Ltd., 2017.

Other Suggested Readings:

1. https://www.udemy.com/course/estimating-and-costing/

DEC CE2131 INTRODUCTION TO LIFE CYCLE ANALYSIS

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1	Understanding the concepts of sustainability
CO2	Challenges engineers face in applying these concepts in an industrial and societal context
CO3	Detail training on how to use LCA.
CO4	Critically analyse environmental emissions and develop simple methodologies to reduce these emissions.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3	2	3	2	–	–	–	–	–	2	–	–	2
CO2	2	3	2	3	2	3	2	–	–	–	–	–	2	–	–	2
CO3	3	3	3	3	3	3	2	–	–	–	–	–	2	–	–	2
CO4	2	3	3	3	3	3	2	–	–	–	–	–	2	–	–	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

An Introduction to Sustainability Concepts and Life Cycle Analysis - Risk and Life Cycle Framework for Sustainability - Environmental Data Collection and LCA Methodology (Overview - Goal Definition, LCI, LCIA, LCI, LCA Software tools) - Life Cycle Assessment – Detailed Methodology and ISO Framework – Life Cycle Inventory and Impact Assessments (Unit Processes and System Boundary Data Quality, Procedure for Life Cycle Impact Assessment, Interpretation of LCIA Results) Factors for Good LCA Study (ISO Terminologies, LCA Steps Recap, Fate and Transport) - Design for Sustainability (Environmental Design for Sustainability: Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis) - Case Studies

Learning Resources:

Text Books:

1. Introduction to Sustainability for Engineers, 1st Edition, Toolseeram Ramjeawon, 2020, ISBN 9780367254452, CRC Press
2. Environmental Life Cycle Assessment, Olivier Jolliet, Myriam Saade-Sbeih, Shanna Shaked, Alexandre Jolliet, Pierre Crettaz, 2015, CRC Press
3. Circular Economy and Sustainability, Volume 1: Management and Policy, Editors: Alexandros Stefanakis, Ioannis Nikolaou, eBook ISBN:9780128203965

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/105/105105157/

DEC CE3161 INTRODUCTION TO STRUCTURAL DYNAMICS

L-T-P (C)
2-0-0 (2)

Pre-requisites: CE2011 Strength of Materials-I, CE2031 Strength of Materials-II

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

CO1 Understanding the elements of dynamic analysis
CO2 Analyze Free vibration of the SDOF system
CO3 Analyze Response SDOF system under harmonic loading and general loading
CO4 Find out mode shape, frequencies and amplitude for motion of MDOF systems
CO5 Analyze the response of continuous system under dynamic loading

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	-	2	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	2	-	2	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	2	-	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	2	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	-	2	-		-	-	-	-	-	2	2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Single Degree of Freedom Systems: Idealization of structures as SDoF system, undamped and damped free vibration response, Response of SDOFS systems to Harmonic, Periodic, Impulse Loads, Response under arbitrary load, numerical evaluation of dynamics response.

Multi degree of Freedom Systems: Free vibration - Determination of Natural frequencies and mode shapes - Vanello Stodola and Matrix iteration methods – Energy Methods – Lagrange's equation – Simple applications.

Continuous Systems: Free and forced vibrations of beams - Approximate solutions - Rayleigh and Rayleigh - Ritz Methods – Vibrating of building frames – modal analysis.

Learning Resources:

Text Books:

1. Structural Dynamics by Mario Paz.; CBS Publishers & Distributors, Delhi.
2. Dynamics of Structures – Theory and Applications to earthquake Engineering by A. K. Chopra, Pearson Education.

Reference Books:

1. Dynamic of Structures by Rav W.Clough & Joseph Penzien; McGraw-Hill,.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/101/105101006/
2. https://archive.nptel.ac.in/courses/105/101/105101209/
3. https://archive.nptel.ac.in/courses/105/106/105106151/

VII SEMESTER

DEC CE3171 SPATIAL ANALYSIS FOR RESOURCE MANAGEMENT

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Familiarize with concepts of choosing map projections, 2D transformation

CO2 Understand the fundamental data models and database preparation

CO3 Familiarize with concepts of geospatial analysis

CO4 Apply the GIS for various civil engineering problems

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	2	2	-	1	1	-	1	3	-	2	1
CO2	3	2	2	1	3	2	2	-	1	1	1	1	3	-	2	2
CO3	2	1	3	2	3	2	2	-	2	3	2	2	2	-	2	2
CO4	3	2	3	2	3	3	3	3	3	3	3	3	2	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction – GIS definition & components of GIS, development, application areas.

Map Concept- Map Definition, Elements of Maps, Types of maps, Advantages and disadvantages of analog/digital maps, Coordinate Systems- Geometric models of earth, Global/Local coordinate system, Projection Systems- Classification, Cylindrical projection, Conical projection, Selection of a particular projection.

Fundamental concepts of GIS – Modelling Real World Features- Raster data model, vector data model, Data Formats- Spatial and Non-Spatial data, Database preparation and editing- Data collection and Input, Data conversion, Hardware & software Requirements, Topology – Editing and Error Rectification, Types of topologies, Topological Relationships.

Spatial Analysis – Buffer Analysis-Variations in Buffering, Applications of buffering, Overlay Analysis-Feature type and overlay, Vector Overlay methods, Network Analysis-Impedance, Shortest path analysis, closest facility, Concepts of Proximity analysis, Neighbourhood operations, DEM and TIN.

GIS Project Planning & **Resource Management**– Steps in GIS project, Problem Identification and Implementation of a GIS project. GIS Applications – Transportation, Water Resources, Environment, Geology, Agriculture, Urban planning, climate change.

Learning Resources:

Text Books:

1. Kang-Tsung Chang, Introduction to Geographic Information Systems, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2015.
2. Peter A. Burrough and Rachael A. McDonnell, Principles of Geographical Information Systems, Oxford University Press, 2016.

Reference Books:

1. C.P. Lo, Albert K. W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt. Ltd, New Delhi, 2009.
2. The design and implementation of Geographic Information Systems, John E. Harmon & Steven J. Anderson., John Wiley & Sons, 2003.

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/102/105102015/
2. https://nptel.ac.in/courses/105/107/105107155/
3. https://nptel.ac.in/courses/107/105/107105088/

DEC CE3181 ENVIRONMENTAL MODELLING L-T-P (C) 3-0-0 (3)

Pre-requisites: None

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

CO1 Understand and apply the concepts of mass balance in various engineered systems

CO2 Assess pollutant transport using mass transport equations

CO3 Calculate the size of the Kolmogorov micro scale in sheared reactors

CO4 Estimate the fractal dimension of flocs in coagulation process and estimate the bulk density of the flocs based on the fractal dimension

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2	3	3	3	2	2	2	3	–	–	3	1
CO2	3	3	2	3	2	3	3	3	2	2	2	3	–	1	3	1
CO3	3	3	3	3	3	3	3	3	3	2	2	3	–	1	3	1
CO4	3	3	3	3	3	3	3	3	3	2	2	3	–	1	3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Basic concepts of mole and mass concentration: notations and conventions, Review of mass balance concepts.

Diffusive transport: Diffusion and Fick's first law, Calculation of molecular diffusion coefficients in air and water.

The constitutive transport equation: Derivation of general transport equation and special forms i.e. continuity and NS equations and similarity between equations of mass momentum and heat dispersion laws.

Theories of mass transport: two film theory, penetration and surface renewal theory, boundary layer theory. Mass transport correlations.

Transport in sheared reactors: Fluid shear and turbulence, transport in steady sheared fluids, turbulent sheared fluids, and shear rates in mixed reactors.

Particles and fractals: Introductions, particle size spectra, solid particles and fractal aggregate geometries, measuring and calculating fractal dimensions from particle size distributions.

Coagulation in natural and engineered systems: Introduction, general coagulation equations, factors affecting the stability of aquasols, coagulation kinetics, fractal coagulation models.

Learning Resources:

Text Books:

1. Environmental Transport Processes by Bruce E. Logan, 2nd Ed., Wiley, 2012.
2. Diffusion: Mass transfer in fluid systems by E.L. Cussler, 3rd Ed., Cambridge University Press, 2007.
3. Introduction to chemical transport in the environment by John S. Gulliver, Cambridge University Press, 2007.
4. Environmental Engineering: A Design Approach by Sincero and Gregoria, PHI Learning, 2009.

Other Suggested Readings:

1. NPTEL COURSE - Environmental Modelling and Simulation

DEC CE4031 DESIGN OF HYDRAULIC STRUCTURES

L-T-P (C)
3-0-0 (3)

Pre-requisites: CE3051 Irrigation Engineering

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

CO1 Analyse and design gravity dams

CO2 Analyse and design earth and rockfill dams

CO3 Design spillways and energy dissipation structures

CO4 Design of penstocks and surge tanks

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1	1	1	-	-	-	-	-	-	-	-	-	2
CO2	3	1	3	1	2	1	-	-	-	-	1	-	-	-	3	-
CO3	3	1	3	1	2	2	-	-	-	-	1	-	-	-	3	-
CO4	3	1	3	1	2	2	-	-	-	-	-	-	-	-	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Dams-Types; Gravity Dams-computation of forces-modes of failure and stability criteria, stability analysis. Elementary and practical profile, limiting the height of gravity dams, Galleries, joints, keys, water stops, instrumentation, grouting. Earth dams-Seepage analysis, phreatic line, flow net construction, criteria for safe design of gravity dams, typical cross sections of earth dams, Stability analysis, Seepage control, design of filters.

Spillways and energy dissipation systems - Essential requirements of spillways, Required spillway capacity, component parts of spillway, Types of spillways, Design of Ogee spillway, Design of shaft spillway, Design of siphon spillway, Design of stilling basins.

Hydropower structures - Storage power plant, Runoff River plant, Pumped storage plant, Water conveyance systems, Tunnels and Penstocks, Gates, Surge tanks, Power house layout.

Learning Resources:

Text Books:

1. Garg S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi 2006.
2. KR Arora. Irrigation, Water Resources and Water Power Engineering, S.B.H Publishers and Distributors, New Delhi. 2010.
3. Punmia, B. C., Lal, P. B. B., Jain, A. K., & Jain, A. K. (2009). Irrigation and water power engineering. Laxmi Publications, Ltd.

Reference Books:

1. Golze, A. R., Handbook of Dam Engineering, Von Rostrand Reinhold Co., 1977.
2. Sharma, H.D., Concrete Dams, CBIP Publication, 1998. 3. Siddiqui, I H, Dams and Reservoirs: Planning, Engineering, Oxford University Press, USA, 2009
3. Novak, P., Moffat, A. I. B., Nalluri, C and Narayan, R., Hydraulic Structures, Taylor & Francis, 2006.
4. Sathyanarayana M. C. Water Resources Engineering-Principles and Practice, New Age International Publishers. 2009

Other Suggested Readings:

1. IS Code 6512: Criteria for Design of Solid Gravity Dams
2. IS Code 7894: Code of Practice for Stability Analysis of Earth Dams
3. IS Code 8826: Guidelines for Design of Large Earth and Rockfill Dams

DEC CE3191 CONSTRUCTION TECHNOLOGY AND PROJECT MANAGEMENT

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1 Understand the roles and responsibilities of a project manager

CO2 Prepare schedule of activities in a construction project

CO3 Understand safety practices in construction industry

CO4 Prepare tender and contract document for a construction project

CO5 Identify the equipment used in construction

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	-	-	3	2	2	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	2	2	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	3	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-

1-Slightly 2-Moderately 3 – Substantially

Syllabus:

Importance of Project Management, Role of Project manager, Stakeholders in construction project, Different types of projects, similarities & dissimilarities in projects., Time, Scope & Money, Knowledge areas & Processes involved in construction projects, WBS of a major work, with examples, Planning, monitoring & executing, Planning, sequencing, scheduling, Bar Charts, Networks, CPM, PERT, Upgrading, Cash flow diagram, resource levelling & resource allocation, Crashing of project, Cost Optimization, Invoicing, Preparation of RA bill,

Safety in construction - Cost of Accidents - Safety norms - Safety aids

Estimation, Tenders & Contracts - EOI- Prequalification - Types of Contract - Terminology used.

Equipment for construction - Earthwork - Concreting - Bitumen - Hoisting etc.,

Construction Finances – decision making,

Learning Resources:

Text Books:

1. Construction Project Management, Kumar Neeraj Jha, Pearson Publication, 2015, Second edition

2. Project Management, Choudhary S, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

3. Project Planning and Control with PERT and CPM, Punmia and Khandelwal K.K., Laxmi Publications Delhi, 2016

Reference Books:

1. Construction project Management, K K Chitkara, Tata McGraw Hill Publishing Company Limited, New Delhi, 2019, Fourth Edition

2. Construction Planning Equipment & methods, Puerifoy R.L, 2010

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/106/105106149/

2. https://nptel.ac.in/courses/105/103/105103093/

DEC CE3201 WATERSHED MANAGEMENT L-T-P (C) 2-0-0 (2)

Pre-requisites: None

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

CO1 Understand watershed characteristics, hydrological processes, and the interrelationship between land, water, and vegetation in a watershed.

CO2 Evaluate the role of ecological, social, and economic factors in sustainable watershed management, including community participation and policy frameworks.

CO3 Utilize geospatial tools and hydrological models for watershed assessment, planning, and decision-making.

CO4 Formulate strategies for sustainable watershed development, addressing water resource management, climate change adaptation, and disaster mitigation.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	2	1	1	1	-	-	-	-	-	-	-	-
CO2	2	1	3	1	2	3	3	1	-	-	-	-	-	-	-	-
CO3	3	1	1	1	3	1	1	1	-	-	-	-	-	-	-	-
CO4	3	1	3	3	2	3	3	3	-	1	1	1	-	-	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction and Basic Concepts: Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making.

Sustainable Watershed Approach & Watershed Management Practices: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; Watershed Management Practices in Arid and Semiarid Regions, Case studies, short term and long-term strategic planning.

Integrated Watershed Management: Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system.

Watershed Modelling: Standard modelling approaches and classifications, system concept for watershed modelling, overall description of different hydrologic processes, modelling of rainfall-runoff process, subsurface flows and groundwater flow.

Social Aspects of Watershed Management: Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies.

Use of modern techniques in watershed management: Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management.

Management of Water Quality: Water quality and pollution, types and Sources of pollution, water quality modelling, environmental guidelines for water quality.

Storm Water and Flood Management: Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage.

Drought Management: Drought assessment and classification, drought analysis techniques, drought mitigation planning.

Water Conservation and Recycling: Perspective on recycle and reuse, Waste water reclamation.

Learning Resources:

Text Books:

1. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
2. Murty, J.V.S. “Watershed Management”, New Age Intl., New Delhi 1998.
3. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 .
4. Purandare, A.P., Jaiswal A.K., Watershed Development in India, NIRD, Hyderabad, 1995.
5. Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

Other Suggested Readings:

1. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
2. Maidment, D. R. (Ed.). (1992). Handbook of hydrology (pp. xx+-1000).

DEC CE4041 DESIGN OF EARTHQUAKE RESISTANCE STRUCTURES

L-T-P (C)
2-0-0 (2)

Pre-requisites: CE3011 - Structural Analysis I; CE3041- Structural Analysis -II

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

CO1 Apply seismic coefficient and response spectrum methods for analysis of multi storied buildings

CO2 Apply concepts of ductility in the design of multi-storeyed structures

CO3 Understand the concepts of base isolation

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	2	3	-	-	1	-	1	-	-	1	-	-	-	2	3
CO2	-	-	3	2	-	1	-	1	-	-	1	-	-	-	3	1
CO3	-	-	2	3	-	1	-	1	-	-	1	-	-	-	2	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

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

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

Analysis for Earthquake Loads: IS: 1893-2016- Seismic Coefficient method- modal analysis- Applications to multi-storied building frames.

Ductile Detailing: Ductility of R.C structures- Confinement- detailing as per IS-13920-2016- moment redistribution – principles of design of beams, columns – beam column joints – soft story concept.

Base Isolation: Isolation systems – Effectiveness of base isolation.

Learning Resources:

Text Books:

1. Pankaj Agarwal and Manish Shrikhande, Earthquake resistant design of structures, PHI 2006.
2. Earthquake resistance design of structures by S. K. Duggal; Oxford University Press.
3. I.S. 1893 - 2016, Criteria for Earthquake Resistance design of Structures.

4. IS 13920 – 2016, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.

Reference Books:

1. Dynamics of Structures – Theory and Applications to earthquake Engineering by A. K. Chopra, Pearson Education.

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/101/105101004/

VIII SEMESTER

DEC CE4051 FINITE ELEMENT METHODS L-T-P (C) 3-0-0 (3)

Pre-requisites: CE3041- Structural Analysis II

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

CO1 Develop shape functions and stiffness matrices different finite elements

CO2 Develop global stiffness matrices and global load vectors

CO3 Apply natural and arial coordinate systems to constant strain triangle and linear strain

CO4 Analyse planar structural systems using finite element modeling

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	-	-	-	1	-	-	-	-	-	-	2	-
CO2	3	3	2	3	-	-	-	1	-	-	-	-	-	-	2	-
CO3	3	3	2	3	-	-	-	1	-	-	-	-	-	-	2	-
CO4	3	3	3	2	-	-	-	1	-	-	-	-	-	-	3	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Matrix Methods of Structural Analysis: Review of concepts – Actions and displacements – compatibility – indeterminacy – Member and joint loads – Flexibility Matrix formulation – Stiffness Matrix formulation.

Introduction to Finite Element Method: Background and general description of the method – summary of the analysis procedure.

Theory of Finite Element method: Discretisation concept- Concept of element – various elements shapes – displacement models – Convergence- shape functions – condensation of internal degrees of freedom- Summary of analysis procedure.

Finite Element Analysis: Development of shape functions for different elements-Spring- Truss- Beam- Plane elements- Plane stress and plane strain-Assemblage of elements construction of stiffness matrix and loads – boundary conditions –patch test-solution of overall problem.

Isoparametric Formulation: Concept of Isoparametric element – One- and Two-dimensional Elements- Natural coordinates- Development of Higher order elements- Lagrange – Serendipity –Interpolation- formulation of element stiffness and loads.

Application to Solid Mechanics problems: Analysis of Trusses – Beams – Frames and 3D space elements.

Learning Resources:

Text Books:

1. Finite Element Analysis: Theory and Programming, C Krishnamoorthy, McGraw Hill Pub., 2017, 2nd Edition.
2. Introduction to Finite elements in Engineering, Tirupathi chandra Patla and Belugundu, Pearson, 2015, 4th Edition,
3. The Finite element Method in Engineering, S. S. Rao, Elsevier Publication, 2020, 6th Edition.

Reference Books:

1. Finite Element Method: Its Basic and Fundamentals, O.C. Zeinkiewicz, Butterworth Heinemann, 2007, 6th Edition.
2. Textbook of Finite Element Analysis, P. Seshu, PHI Pub., 2003
3. Introduction To Finite Element Method, J. N. Reddy, McGraw Hill Pub., 2020, 4th Edition
4. Fundamentals of finite element analysis, David Hutton, McGraw Hill Pub., 2017.
5. Numerical Methods in Finite Element Analysis, Bathe K J, Prentice-Hall civil engineering
6. and engineering mechanics series, 2016.

Other Suggested Readings:

1. https://nptel.ac.in/courses/112106135
2. https://www.youtube.com/playlist?list=PLD4017FC423EC3EB5
3. https://nptel.ac.in/courses/105105041

DEC CE4061 ADVANCED FOUNDATION DESIGN

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Understand the behavior of problematic soil

CO2 Design foundations on expansive soils

CO3 Analysis of shallow Foundation

CO4 Analyze the lateral stability of piles and wells

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	-	2	2	1	-	2	2	3	2	3	-	3
CO2	1	2	2	3	-	2	2	2	-	2	2	3	2	-	2	2
CO3	1	2	-	2	2	2	-	1	2	2	3	2	2	1	1	2
CO4	1	2	2	3	2	2	-	1	-	2	2	2	-	-	2	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Problematic soils: Different types of problematic soils – Soft Clays, Loose Sands, Expansive soils, Erodible soils and Collapsible soils, Identification, categorization and problems associated with these soils, Geotechnical remedies for rectification of damage potential of these soils.

Expansive soils: Identification and characteristics of Expansive soils, Free swell index and swell potential, Swell pressure – Factors –Test, Effect of swelling on building foundations, Fundamental design in expansive soil – CNS layer, Under reamed pile and other concepts, Problems.

Shallow foundations: Individual footings, Combined Footings and Mat/Raft foundations - Computation of loads – Design steps – Proportioning of footings, Bearing capacity and settlements of foundations, Types of rafts – Conventional methods of design (Rigid beam analysis), Beams on Elastic foundations, Problems.

Pile foundations: Pile behavior under axial loads (piles under compression) – Review uplift capacity / resistance of piles (piles under tension), Lateral load capacity/ Resistance of piles, Winkler's hypothesis – Differential equations, Brom's solution for laterally loaded vertical piles in sand and clay, IS Code method, Problems.

Well foundations: Introduction – types and shapes of Caissons – Grip length, Estimation of bearing capacity and settlement of well foundation Design of various elements/components of well foundation, Forces acting on well foundation, Lateral stability of well foundations by IRC method, Problems.

Learning Resources:

Text Books:

1. Murthy V.N.S (2007): Soil Mechanics and Foundation Engineering – CBS publications, Delhi.

2. Das, BM (2009): Geotechnical engineering – Cengage learning, New Delhi.

3. Gopal Ranjan, Rao ASR (2000): Basic and applied soil mechanics – New age publication, Delhi.

Reference Books:

1. Bowles, J. E., & Guo, Y. *Foundation analysis and design*. New York: McGraw-hill.

2. Berlinov, M. *Foundation analysis and design*. Mir.

3. Foundation Engineering – Geotechnical Principles & Practical applications, Richard L Handy, Mc Graw Hill, New York, 2020

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/105/105105039/

2. https://nptel.ac.in/courses/105104162

DEC CE4071 ADVANCE MECHANICS OF SOLIDS

L-T-P (C)
3-0-0 (3)

Pre-requisites: CE2011 Strength of Materials-I, CE2031 Strength of Materials-II

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

CO1 Apply principles of elasticity theory to determine stresses and strains
CO2 Apply theory of elasticity and formulate plane stress and plane strain problems
CO3 Formulate the stress analysis problems using elasticity theory
CO4 Apply experimental techniques to solve field problems

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	2	-	-	-	1	-	2	-	1	-	2	1	-
CO2	2	-	-	2	-	-	-	1	-	2	-	2	-	2	1	-
CO3	2	2	-	2	-	-	-	1	1	1	-	1	-	2	1	1
CO4	2	3	-	1	-	-	-	1	2	2	-	2	-	1	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction to Continuum Mechanics: Assumptions made in elasticity theory, Necessary and sufficient conditions for analysing a structure, Specification of stress at a point, Specification of stress at a point- Determination of normal thrust and shear stress

Concept of Orthogonal Transformation of axes: Determination of Stress invariants, Determination of principal stresses and planes, Determination of maximum shear stresses and their corresponding planes, Tresca's criteria.

Derivation of Equilibrium conditions in three dimensions: Concept of Strain at a point, Determination of Normal and Shear Strain, Generalized Hooke's Law, Interrelationship between stresses and Strains in three dimensions, Formulation of a plane stress problem.

Derivation of Airy's Stress function: Boundary conditions, equilibrium equations, compatibility conditions, solution to stress analysis problems based on direct, inverse and semi-inverse methods

Introduction to Experimental stress analysis: Strain measurement- Types of strain gauges, Characteristics of ideal strain gauges, gauge factor, Strain gauge Rosettes, Introduction to two-dimensional photo elasticity, Stress-Optic law.

Learning Resources:

Text Books:

1. Theory of Elasticity, S. Timoshenko and J N Goodier, McGraw Hill Education; 2017, 3rd Edition.

2. Advanced Mechanics of Solids, L.S. Srinath, McGraw Hill, Delhi 2009, 3rd Edition.

3. Theory of Elasticity, T.G.Sitharam, L.Govinda Raju, Springer, 2021.

Reference Books:

1. A Treatise on the Mathematic Theory of Elasticity, A.E.H.Love, , Cambridge University Press, 2013.

2. Applied Elasticity, Matrix and Tensor Analysis of Elastic Continuum, Horwood Publishing Limited, 2005.

3. Advanced Mechanics of Solids and Structures, N.Krishna Raju, Mc Graw Hill Education(India) Pvt Ltd, 2018.

4. Experimental Stress Analysis, J.W. Dally and W.F.Riley, Mc Graw Hill 1991, 3rd Edition.

Other Suggested Readings:

1. https://onlinecourses.nptel.ac.in/noc21_ce45/

DEC CE4081 TRAFFIC ENGINEERING

L-T-P (C)
3-0-0 (3)

Pre-requisites: CE2061 Transportation Engineering -I

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

CO1 Study fundamental characteristics of traffic stream and Drivers' behavior.

CO2 Understand different types of traffic control systems.

CO3 Design traffic signal system at intersections

CO4 Estimate capacity and Level of Service for uninterrupted and interrupted flow facilities.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	2	2	1	1	2	2	2	3	2	2	2
CO2	3	3	3	2	3	2	2	1	1	2	2	2	2	2	3	2
CO3	3	3	3	3	3	2	3	1	1	2	2	2	2	2	3	3
CO4	3	3	3	3	3	2	3	1	1	2	2	2	2	2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Vehicle Characteristics, Human Factors and Driver behavior; Traffic information and control systems; Traffic studies- volume, speed and delay studies; Elements of traffic flow theory; Characteristics of uninterrupted traffic, capacity and Level of Service (LOS) of Uninterrupted facilities, characteristics of interrupted traffic; Traffic characteristics at unsignalized intersections; Design of signalized intersections; Capacity and LOS of signalized intersections, actuated signal control, signal coordination.

Learning Resources:

Text Books:

1. Roger P. Roess, William R. McShane & Elena S. Prassas, Traffic Engineering, Prentice-Hall, 1990.

2. Pignataro L. J., Traffic Engineering – Theory and Practice, Prentice Hall, 1973.

Reference Books:

1. C. J. Khisty and B. K. Lall, Transportation Engineering: An Introduction, Prentice-Hall India, 2003.

2. Wohl M. and Martin B. V., Traffic System Analysis, McGraw-Hill Book Company,1967.

3. P. Chakroborty and A. Das, Principles of Transportation Engineering, Prentice Hall of India Pvt. Ltd.,2003.

4. L. R. Kadiyali, Traffic Engineering, Khanna Publishers, 2000.

5. A. D. May, Traffic Flow Fundamentals, Prentice–Hall, 1990.

6. C.S. Papacostas, Transportation Engineering and Planning, Prentice-Hall India, 2001.

7. Highway Capacity Manual (HCM), Transportation Research Board, USA, 2000

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/105/105105215/

DEC CE4091 REPAIR AND REHABILITATION OF STRUCTURES

L-T-P (C)
3-0-0 (3)

Pre-requisites: CE2041 Concrete Technology, CE3021 Design of Concrete Structures

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

CO1 Identify the reasons for distress and deterioration of structures.

CO2 Apply Non-Destructive Testing techniques for condition assessment of structures in distress

CO3 Select a suitable repair material for various field applications

CO4 Select suitable repair and rehabilitation methods for Civil Infrastructure

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	-	1	-	2	2	-	1	-	2	-	-
CO2	2	2	1	3	3	-	-	-	2	-	-	2	-	-	2	-
CO3	2	1	1	-	-	-	2	1	1	-	1	1	-	3	2	-
CO4	3	1	2	1	1	-	-	1	1	1	1	2	-	1	2	-

1-Slightly 2-Moderately 3 - Substantially

Syllabus:

Introduction: Causes of distress in concrete structures- Permeability of concrete, aggressive chemical agents, durability aspects, Holistic models for deterioration of concrete

Condition Survey: Preliminary inspection, planning stage, visual inspection, field laboratory testing stage, consideration for repair strategy

Non-Destructive Evaluation tests: Estimation of Strength, Chemical and other durability tests, estimation of corrosion potential

Selection of repair materials for concrete: Ideal characteristics for selection of repair materials, premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy and epoxy systems

Repair /Rehabilitation methods: Shortcreting and Guniting. Repair and strengthening of columns and beams using ferrocement jacketing, fiber wrap technique, Foundation Rehabilitation methods

Learning Resources:

Text Books:

1. Concrete Structures-Repair, Rehabilitation and Retrofitting, B.Bhattacharjee, CRS Publishers and Distributors, 2017.

2. Concrete Structures-Protection, Repair and Rehabilitation, R.Dodge Woodson, Elsevier,2009.

3. Concrete Technology, Santhakumar A.R, Oxford University Press, New Delhi, 2007

Reference Books:

1. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt of India Press, New Delhi, 2014.

2. ACI 546R-14, Guide to Concrete Repair, American Concrete Institute, 2014

Other Suggested Readings:

1. https://nptel.ac.in/courses/105/106/105106202/

2. https://www.concrete.org/store/productdetail.aspx?ItemID=W1506&Format=ONLINE_LEARNING&Language=English&Units=US_Units
3. https://www.classcentral.com/course/swayam-maintenance-and-repair-of-concrete structures-17678

4. https://www.classcentral.com/course/swayam-maintenance-and-repair-of-concrete structures-17678

DEC CE4101 SOLID WASTE MANAGEMENT L-T-P (C) 3-0-0 (3)

Pre-requisites: None

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

CO1 Appreciating the fundamentals of solid waste

CO2 Analyze solid waste generation and collection

CO3 Explore Waste recovery and treatment technologies

CO4 Apply principles of recycling and circular economy

CO5 Demonstrate critical thinking through case studies

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	2	3	3	3	2	2	2	3	–	–	3	1
CO2	3	3	2	3	2	3	3	3	2	2	2	3	–	1	3	1
CO3	3	3	3	3	3	3	3	3	3	2	2	3	–	1	3	1
CO4	3	3	3	3	3	3	3	3	3	2	2	3	–	1	3	1
CO5	2	3	2	3	2	3	3	3	2	2	2	3	–	–	–	–

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Evolution, Sources, Composition, and Properties of Solid Waste: Introduction to solid waste; Functional elements; Sources, types, and composition of MSW; Physical, chemical and biological properties of MSW.

Waste Generation, Handling, Collection and Transport: Solid waste generation and collection rates; Waste handling and separation, storage and processing at the source; Collection of solid waste; Transfer and Transport.

Waste Processing, Recovery and Disposal: Materials-recovery Facilities; Material separation and processing techniques; Thermal conversion technologies; Biological and chemical conversion technologies; Disposal of solid waste and residual matter.

Recycling, Minimization and Circular Economy: Principles and benefits of recycling; Circular economy principles in waste management; Emerging trends in SWM technologies, Introduction to Biomedical, Hazardous and E-Waste.

Case studies: Landfill, Composting, Anaerobic digestion etc.

Learning Resources:

Text Books:

1. Tchobanoglous G, Theisen H and Vigil SA, Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw Hill Education, 2014, Indian Edition.

2. John Pichtel,Waste Management Practices: Municipal, Hazardous and Industrial, CRC Press, 2014, 2nd Edition

Reference Books:

1. Vesilind PA, Worrell W and Reinhart D,Solid Waste Engineering, Brooks/Cole Thomson Learning Inc., 2010, 2nd Edition

2. Peavy, H.S., Rowe, D.R., and Tchobanoglous G., Environmental Engineering, McGraw Hill Education, 2017 First Indian Edition

Other Suggested Readings:

1. NPTEL: Municipal Solid Waste Management http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php

Open Elective Courses

IV SEMESTER

OEC CE2141 BUILDING TECHNOLOGY

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Apply basic principles to develop stable, sustainable and cost-effective building plans

CO2 Identify effective measures for fireproofing, damp proofing, and thermal insulation.

CO3 Adopt standard building provisions for natural ventilation and lighting.

CO4 Identify different materials, quality and methods of fabrication & construction.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	-	-	2	2	-	-	3	-	-	-	-	2	-
CO2	3	-	2	-	-	-	2	-	-	3	-	-	-	-	2	-
CO3	3	-	2	-	-	-	2	-	-	-	-	-	-	-	2	-
CO4	3	-	2	-	-	-	2	-	-	-	-	-	-	-	2	-

1 – Slightly 2 - Moderately; 3 – Substantially

Syllabus:

Overview of the course, basic definitions, Buildings – Types, components, economy and design, Principles of planning of buildings and their importance. Definitions and importance of Grouping and circulation; Lighting and ventilation; How to consider these aspects during planning of building

Termite proofing – Inspection, control measures and precautions, Lighting protection of buildings: General principles of design of openings, Various types of fire protection measure to be considered while planning a building.

General requirements and extra requirements for safety against fire, special precautions, Vertical transportation in building – types of vertical transportation, Stairs, different forms of stairs, planning of staircases, other modes of vertical transportation – lifts, ramps, escalators.

Prefabrication systems in residential buildings – walls, openings, cupboards, shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, Principles, Seismic forces and their effect on buildings.

Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation – importance and measures.

Plumbing services – water supply system, maintenance of building pipeline, Sanitary fittings, principles governing design of building drainage.

Learning Resources:

Text Books:

1. Building Construction, Punmia B. C., Jain A.J., and Jain A.J., Laxmi Publication, 2016, Eleventh Edition.

2. The Textbook for Building Construction, Arora S. P., and Bindra S. P., Dhanpat Rai Pubications, 2010

Reference Books:

1. Building Construction, Varghese P.C., PHI Learning Pvt. Ltd., 2017, 2nd Edition.
2. National Building Code of India, Bureau of Indian Standards, 2016.

Other Suggested Readings:

1. https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf
2. https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf
3. https://www.grihaindia.org/griha-ah

V SEMESTER

OEC CE3211 CONSTRUCTION MANAGEMENT

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Explain about construction project management and its relevance as well as ethical conduct of engineers

CO2 Work out economics of the construction project

CO3 Manage procurement of construction materials and inventory

CO4 Implement quality control/ management technique during constructions

CO5 Implement safety management and form safety policies in construction projects

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	1	3	-	-	-	2	2	2	-	2	2	2	1
CO2	3	3	2	1	3	-	-	-	2	2	3	-	2	2	2	1
CO3	3	1	2	2	3	-	-	-	2	2	2	-	2	2	2	1
CO4	3	1	2	2	3	-	-	-	2	2	2	-	2	2	2	1
CO5	3	1	2	2	3	-	-	-	2	2	2	-	2	2	2	1

1-Slightly 2-Moderately 3 - Substantially

Syllabus:

Introduction: Indian construction industry, Construction project management and its relevance, Stakeholders of a construction project, Project organization.

Project Planning, Monitoring & Execution: Planning, sequencing, scheduling, Bar Charts, Networks, CPM, PERT, Upgrading, Cash flow diagram, resource levelling & resource allocation, Crashing of project, Cost Optimization, Invoicing, Preparation of RA bill,

Construction Material Management: Material procurement process, Materials management functions – planning, procurement, custody, materials accounting, transportation, inventory monitoring and control, materials codification, source development, disposal. Inventory management – inventory related cost, functions of inventory, inventory policies, selective inventory control, inventory models.

Construction Quality Management: Description of quality, Evolution of quality, Inspection and quality control. Total quality management, ISO standards, Audit, Construction productivity, Typical causes of low labour productivity.

Learning Resources:

Text Books:

1. Construction Project Management – Theory and Practice – Kumar Neeraj Jha, Pearson

2. Construction Project Management – Planning, Scheduling and Controlling – K.K. Chitkara, McGraw Hill Education (India) Private Limited

Reference Books:

1. Construction Management and Machinery – B.L. Gupta & Amit Gupta, Standard Publishers Distributors

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/104/105104161/

VI SEMESTER

OEC CE3221 ENVIRONMENTAL MANAGEMENT

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Comprehend the need for Environmental Management
CO2 Identify the attributes of the Environment Management system and standards
CO3 Apply different methodologies for impact assessment
CO4 Identify the techniques and control measures for Environment management

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2	2	2	2	1	2	2	-	-	1	-	-	-
CO2	1	2	2	1	2	2	2	2	2	1	-	-	-	-	2	-
CO3	1	2	2	1	2	1	2	2	1	-	-	1	-	-	1	1
CO4	1	2	2	2	3	2	3	1	3	1	2	1	-	-	1	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction to Environmental Management: Scope and nature of Environment Management. Its need and brief discussion on the ethical, legal and financial reasons for Environment Management, the framework and approach to develop Environment management system. Policies and legal aspect in India.

Environment management system (EMS) standard: Guideline to implement effective Environment management system, core element of EMS, EMS standard: ISO 14000, its evolution, principle and specification, benefit of EMS. Planning and its implementation, Comparison of other standards with ISO 14000.

Environmental Impact Assessment: EIA definition, its need and principle, scoping, screening and the baseline condition, different methodologies, Impact identification and decision making. EIA case studies in India.

Environment management plan: Planning and identification of baseline condition and impact, monitoring and evaluation of risk, mitigation plan, legislation and environmental audit, disaster management plan, Life cycle assessment and risk analysis.

Environmental management techniques and control measure: Environmental monitoring, modelling and risk assessment. Implementation of sustainable design, control measure for different environment pollution such as air pollution, water pollution, soil and noise pollution.

Learning Resources:

Text Books:

1. Iyyanki V. Muralikrishna and Valli Manickam, Environmental management: Science and Engineering for Industry, Butterworth-Heinemann, 2017.

2. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001

Reference Books:

1. Harry W. Canter, Environmental Impact Assessment, McGraw Hill, 1996, 2nd edition.

2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York,1996.

3. Anjaneyulu.Y., and Manickam. V., B.S. Environmental Impact Assessment Methodologies, Publications, Hyderabad, 2007.

4. Wathern.P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.

5. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002 Paul L Bishop 'Pollution Prevention: Fundamentals and Practice', McGraw- Hill international, Boston, 2000

Other Suggested Readings:

1. NPTEL: Environmental Impact Assessment for Environmental Health

VII SEMESTER

OEC CE3231 INFRASTRUCTURE FOR SUSTAINABLE CITIES

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 Acquaint knowledge on smart cities planning and development
CO2 Develop work break down structure, scheduling and project management of smart cities
CO3 Work out the most energy efficient technique

Course Articulation Matrix:

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

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems

Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.

Intelligent transport systems: Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, Internet of Things (IoT)

Management of water resources and related infrastructure: Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system

Infrastructure Management system & Policy for Smart city: Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.

Learning Resources:

Text Books:

1. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend

Reference Books:

1. Beyond Smart Cities: How Cities Network, Learn and Innovate, Tim Campbell, ISBN: 978-1-84971-426-6
2. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
3. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997
4. Mission statement &guidelines on Smart City Scheme. Government of India - Ministry of Urban Development

Other Suggested Readings:

1. https://archive.nptel.ac.in/courses/105/102/105102195/
2. https://archive.nptel.ac.in/courses/109/105/109105190/

OEC CE3241 DISASTER MANAGEMENT

L-T-P (C)
3-0-0 (3)

Pre-requisites: None

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

CO1 To impart knowledge about various types of disasters

CO2 To introduce the fundamental concepts relevant to various aspect of disaster management

CO3 To enable the students to understand the applicability of science and technology for disaster management

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	1	-	1	1	-	-	1	-	-	-	-	-	2
CO2	1	-	-	-	-	3	1	1	1	-	1	1	-	-	-	3
CO3	3	2	1	1	2	2	1	-	-	-	-	1	1	-	-	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Understanding Disasters: Understanding the Concepts & definitions of Disaster; Terminologies associated with disaster-Hazard, Vulnerability, Risk, Capacity; Classification of disasters (Causes, Consequences, Control, Trends and management of Disasters)- Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters); Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Postdisaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies

Applications of Science and Technology for Disaster Management: Geo-informatics in Disaster Management (RS, GIS and GPS) Disaster Communication System

Learning Resources:

Text Books:

1. Introduction to International Disaster Management by D. P. Coppola, 2007, Elsevier Science (B/H), London

2. Disaster Management by W. Nick. Carter, 1991: Asian Development Bank, Manila

3. Manual on natural disaster management in India by M C Gupta, NIDM, New Delhi.

Other Suggested Readings:

1. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

ESC (Engineering Science Courses)

ESC CE1051 ENVIRONMENTAL SCIENCE AND ENGINEERING

L-T-P (C)
2-0-0 (2)

Pre-requisites: None

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

CO1 Identify environmental problems arising due to engineering and technological activities

CO2 To understand the environmental impact of various episodes and also the effects of different of pollutants

CO3 Assess water demand and design components of water treatment systems

CO4 Assess sources and effects of air and noise pollution and identify appropriate control

CO5 Understand the techniques and methods used in transformation, conservation, and recovery of materials from solid wastes

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	2	3	1	-	-	-	-	1	1	2	2
CO2	3	3	3	-	-	2	3	1	-	-	-	-	2	-	2	1
CO3	3	3	3	-	-	2	3	1	-	-	-	-	2	1	1	1
CO4	3	3	3	-	-	2	3	1	-	-	-	-	2	-	1	2
CO5	3	3	3	-	-	2	3	1	-	-	-	-	1	-	-	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Introduction to Environmental Pollution; Evolution of Pollution Control Strategies and Environmental Infrastructure; Major Environmental Episodes; Evolution of Environmental Acts and Policies; Environmental Ethics; Sustainability Concepts

Water & Wastewater Treatment: Water quality Standards, overview of water treatment, sources and types of pollutants, their effects, principles of wastewater treatment

Air & Noise Pollution: Sources, classification and their effects, national ambient air quality standards (NAAQS), air quality index, control of air pollution, understanding and improving indoor air quality, sources of noise pollution, effects, quantification of noise pollution.

Solid Waste Management: characteristics of solid waste, 3R concept, sustainable practices in waste management, Guidelines for solid waste management, transition to zero waste lifestyle

Learning Resources:

Text Books:

1. G.B. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 2013.

2. Gerard Kiely, Environmental Engineering, McGraw Hill Education Pvt Ltd, Special Indian Edition, 2007.
3. Rajagopalan, Environmental Studies, Oxford IBH Pub,2011

Other Suggested Readings:

1. W P Cunningham, M A Cunningham, Principles of Environmental Science, Inquiry and Applications, Tata McGraw Hill, Eighth Edition, 2016.
2. Environmental Studies: A Practitioner's Approach by by S. J Arceivala and S. R Asolekar, Tata McGraw- Hill Education Private Limited, 2012.
3. Rosencranz, A., Divan, S. and Noble, M.L., Environmental Law and Policy in India: Cases, Materials and Statutes, Tripathi Pvt. Ltd, Bombay, 1992.