Revised UG Programme Structure & Syllabi for B. Tech. Civil Engineering (2024 - 25 batch onwards)

Department of Civil Engineering
Punjab Engineering College
(Deemed to be University)
Chandigarh, India

First Year

Semester-I

Course Code	Course Name	L	T	P	Credits
OR2301	Orientation	-	-	-	1
OR2302	Introduction to Discipline Engineering	1	0	0	1
MA2301	Calculus	3	0	2	4
PY2302	Mechanics and Optics	3	0	2	4
GS2301	Introduction to Environmental Sciences	1	0	0	1
HS2351	Communication Skills	2	0	2	3
ES2301	Introduction to Computer Programming	3	0	2	4
ES2306	Strength of Materials	3	0	2	4
				Total Credits:	**22**

Semester-II

Course Code	Course Name	L	T	P	Credits
MA2302	Linear Algebra, Differential Equations and Vector Calculus	3	0	2	4
CH2302	Applied Chemistry – II (Civil & Production)	3	0	2	4
ES2302	Engineering Drawings with CAD Software	2	0	4	4
GS2302	Universal Human Values	1	0	0	1
ES2303	Skill Development Workshop	0	0	4	2
ES2307	Introduction to Product Design	0	0	4	2
ES2304	Introduction to Mechatronics	3	0	2	4
				Total Credits:	**21**

Second Year

Semester-III

Course Code	Course Name	L	T	P	Credits	Course Type
CVN301	Geo-informatics	3	0	2	4	Core Course
CVN302	Structural Analysis –I	3	0	2	4	Core Course
CVN303	Fluid Mechanics	3	0	2	4	Core Course
CVN304	Building Material and Building Construction	3	0	2	4	Core Course
CVN305	Transportation Engineering	3	0	2	4	Core Course
	SWAYAM (MOOCs) course online	-	-	-	3	Open Elective Course – I
	Total Credits:				**23**	

Semester-IV

Course Code	Course Name	L	T	P	Credits	Course Type
	EVC by Wadhwani Foundation (HSM – II)	-	-	-	3	
CVN401	Design of concrete structure-I	3	0	2	4	Core Course
CVN402	Structural analysis –II	3	0	0	3	Core Course
CVN403	Soil Mechanics – T&P	3	0	2	4	Core Course
CVN404	Irrigation Engineering & Open Channel Hydraulics	3	0	0	3	Core Course
CVN405	Environmental Engineering–I	3	0	0	3	Core Course
CVN406	Railway, Airport & Tunnel Engineering	3	0	0	3	Core Course
	Total Credits:				**23**	

Third Year

Semester-V

Course Code	Course Name	L	T	P	Credits	Course Type
CVN501	Design of steel structure	3	0	0	3	Core Course
CVN502	Design of concrete structures –II	3	0	0	3	Core Course
CVN503	Environmental Engineering- II	3	0	2	4	Core Course
CVN504	Hydrology and design of Hydraulic Structures	3	0	0	3	Core Course
CVN505	Foundation Engineering	3	0	0	3	Core Course
CVP511	Minor Project	0	0	8	4	Core Course
				Total Credits:	**20**	

Semester-VI

Course Code	Course Name	L	T	P	Credits	Course Type
CVN601	Internship Part-I	0	0	12	6	Core Course
CVN602	Internship Part-II	0	0	4	2	Core Course
CVN603	Internship Part-III	0	0	8	4	Core Course
				Total Credits:	**12**	
	OR					
	Optional Course Work					
	Course Name	**L**	**T**	**P**	**Credits**	**Course Type**
CEE112, CEE116, CEE119, CEE121	Deptt. Elective Course-V	3	1	0	4	Elective Course
CEO101	Disaster Management	3	1	0	4	Open Elective Course
CVP601	Project Work	0	0	8	4	Core Course
				Total	**12**	

Fourth Year

Semester-VII

Course Code	Course Name	L	T	P	Credit	Course Type
	HSM – IV	3	0	0	3	
CEE105-10	Departmental Elective Course – I	3	1	0	4	Elective Course
CEE111-15	Departmental Elective Course – II	3	1	0	4	Elective Course
CEO101/ CEO102	Disaster Management/ Green Buildings	3	1	0	4	Open elective Course-II
CVP701	Major Project – I	0	0	8	4	Core Course
				Total Credits:	**19**	

Semester-VIII

Course Code	Course Name	L	T	P	Credit	Course Type
	HSM – III	3	0	0	3	
CEE101-02, CEE116-19	Departmental Elective Course – III	3	1	0	4	Elective Course
CEE103-04, CEE120-23	Departmental Elective Course – IV	3	1	0	4	Elective Course
CEO103	Clean Technology	3	1	0	4	Open Elective Course - III
	Proficiency – I	0	0	2	2	
CVP801	Major Project – II*	0	0	8	4	Core Course
				Total Credits:	**21**	

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HONOURS DEGREE IN CIVIL ENGINEERING

Course Code	Course Name	L	T	P	Credits	Course Type
CEH101	Honours Project-I	0	0	6	3	Honours
CEH102	Honours Project-II*	0	0	8	4	Honours
CEH103	Honours Project-III**	0	0	10	5	Honours
				Total Credits	**12**	

MINOR SPECIALIZATION IN CIVIL ENGINEERING

Course Code	Course Name	L	T	P	Credits	Course Type
CEM101	Structure Analysis and Design	3	0	2	4	Minor
CEM102	Intelligent Transportation Systems	3	1	0	4	Minor
CEM103	Water and Waste Water Engineering	3	1	0	4	Minor
CEM104	Minor Specialization Project–I	0	0	6	3	Minor
CEM105	Minor Specialization Project–II*	0	0	6	3	Minor
				Total Credits	**18**	

MINOR SPECIALIZATION IN SUSTAINABLE INFRASTRUCTURE ENGINEERING

Course Code	Course Name	L	T	P	Credits	Course Type
CEM201	Green Buildings	3	0	2	4	Minor
CEM202	Environmental Impact Assessment	3	1	0	4	Minor
CEM203	Road Safety	3	1	0	4	Minor
CEM204	Minor Specialization Project–I	0	0	6	3	Minor
CEM205	Minor Specialization Project–II*	0	0	6	3	Minor
				Total Credits	**18**	

- To get Honours, the student will have to complete additional 12 credits of discipline electives.
- Minor specialization will be given to a student who earns 18 credits from the basket of MSC offered by one department (outside the parent department).

Minimum credits for award of degree = 161

Credits to be earned for degree with Honours = 161 + 12 = 173

Credits to be earned for degree with Minor Specialization = 161 + 18 = 169

* It is proposed that 'A+' grade should only be given to students who have at least one paper accepted/published in refereed Journal or full length papers published in peer reviewed

conferences organized by IISC/IIT/NIT/IIIT/Premier R&D organizations/ Professional societies or any patent published or first 3 position holders in any reputed national hackathons or project competitions or participation in International hackathons or project competitions.

** It is proposed that 'A+' grade should only be given to students who have at least one paper accepted/published in SCI/SCIE/SSCI/Web of Science/SCOPUS Indexed Journals or any patent published or first 3 position holders in any reputed national hackathons or project competitions or participation in International hackathons or project competitions.

*** The following ESC courses are proposed to be mandatory for all branches: -

i. Computer Programming (ESC-I)

ii. Engineering Drawing (ESC-II)

iii. Workshop (IoT/ECE/SIEMENS etc.) (ESC-III)

HONOURS / MINOR SPECIALIZATION PROGRAMME

Students with good academic performance (having CGPA $\geq$ 8.5 for Honours and CGPA $\geq$ 7 for Minor specialization) and desirous of excelling further in academics have the following opportunities:

a) **Honours:** To get Honours in the parent discipline, a student will have to earn additional 12 credits (over and above 161 credits) in the parent department.

b) **Minor Specialization:** To get Minor specialization, a student will have to complete 18 credits (over and above 161 credits) by doing courses outside the parent department during the entire duration of the programme in the institute.

Honours/ Minor specialization will be awarded to a student on the recommendation of the DAPC of the parent department. A student may do Honours, Honours with Minor Specialization OR Minor Specialization only.

1. Department Core Courses (DCC)

Course Code	Course Name	L	T	P	Credits	Course Type
CVN301	Geo-informatics	3	0	2	4	Core Course
CVN302	Structural analysis –I	3	0	2	4	Core Course
CVN303	Fluid Mechanics	3	0	2	4	Core Course
CVN304	Building Material and Building Construction	3	0	2	4	Core Course
CVN305	Transportation Engineering	3	0	2	4	Core Course
CVN401	Reinforced Concrete Design -I	3	0	2	4	Core Course
CVN402	Structural analysis –II	3	0	0	3	Core Course
CVN403	Soil Mechanics	3	0	2	4	Core Course
CVN404	Irrigation Engineering and Open Channel Hydraulic	3	0	0	3	Core Course
CVN405	Environmental Engineering – I	3	0	0	3	Core Course
CVN406	Railway, Airport & Tunnel Engineering	3	0	0	3	Core Course
CVN501	Design of steel structure	3	0	0	3	Core Course
CVN502	Reinforced concrete design–II	3	0	0	3	Core Course
CVN503	Environmental Engineering- II	3	0	2	4	Core Course
CVN504	Hydrology and Hydraulic Structures	3	0	0	3	Core Course
CVN505	Foundation Engineering	3	0	0	3	Core Course

2. Department Elective Courses (DEC)

Department Elective Courses – I

Course Code	Course Name	L	T	P	Credits	Course Type
CEE105	Concrete Technology	3	1	0	4	Elective Course
CEE106	Multi Modal Urban Transportation System	3	1	0	4	Elective Course
CEE107	Construction Project Management and Economics	3	1	0	4	Elective Course
CEE108	Solid Waste Management	3	1	0	4	Elective Course
CEE109	Engineering Geology	3	0	2	4	Elective Course
CEE110	Ground Water Hydraulics	3	1	0	4	Elective Course

Department Elective Courses – II

Course Code	Course Name	L	T	P	Credits	Course Type
CEE111	Design of Steel Structures - II	3	1	0	4	Elective Course
CEE112	Road Safety	3	1	0	4	Elective Course
CEE113	Hydro Power Engineering	3	1	0	4	Elective Course
CEE114	Unit Processes in water and waste water treatment	3	1	0	4	Elective Course
CEE115	Disaster Management	3	1	0	4	Elective Course

Department Elective Courses – III

Course Code	Course Name	L	T	P	Credits	Course Type
CEE101	Seismic design of Structures	3	1	0	4	Elective Course
CEE116	Traffic Engineering	3	1	0	4	Elective Course
CEE117	Stochastic Hydrology	3	1	0	4	Elective Course
CEE118	Environmental Pollution Management	3	1	0	4	Elective Course
CEE102	Remote Sensing and GIS	3	0	2	4	Elective Course
CEE119	Green Building Materials and Techniques	3	1	0	4	Elective Course

Department Elective Courses – IV

Course Code	Course Name	L	T	P	Credits	Course Type
CEE120	Bridge Engineering	3	1	0	4	Elective Course
CEE103	Transportation Planning & Management	3	1	0	4	Elective Course
CEE121	Water Resources Planning and Management	3	1	0	4	Elective Course
CEE104	Environmental Impact Assessment	3	1	0	4	Elective Course
CEE122	Reinforced Soil Analysis and Design	3	1	0	4	Elective Course
CEE123	Clean Technology	3	1	0	4	Elective Course

Department Elective Courses – V

Course Code	Course Name	L	T	P	Credits	Course Type
CEE101	Seismic design of Structures	3	1	0	4	Elective Course
CEE102	Remote Sensing and GIS	3	0	2	4	Elective Course
CEE103	Transportation Planning & Management	3	1	0	4	Elective Course
CEE104	Environmental Impact Assessment	3	1	0	4	Elective Course

3. Open Elective Courses (OEC)

Course Code	Course Name	L	T	P	Credits	Course Type
	MOOC Course	-	-	-	4	Open Elective Course -I
CEO101/ CEO102	Disaster Management/ Green Buildings	3	1	0	4	Open Elective Course-II
CEO103	Clean Technology	3	1	0	4	Open Elective Course-III

Open Elective Course (VI Semester)

Course Code	Course Name	L	T	P	Credits	Course Type
CEO 1001	Disaster Management	3	1	0	4	Open Elective Course

4. Minor Specialization Courses

Minor Specialization (Civil Engineering)

Course Code	Course Name	L	T	P	Credits	Course Type
CEM 101	Structural Analysis and Design	3	1	0	4	Minor
CEM 102	Intelligent Transportation System	3	1	0	4	Minor
CEM 103	Water and Waste Water Engineering	3	1	0	4	Minor

Minor Specialization (Sustainable Infrastructure Engineering)

Course Code	Course Name	L	T	P	Credits	Course Type
CEM201	Green Buildings	3	1	0	4	Minor
CEM202	Environmental Impact Assessment	3	1	0	4	Minor
CEM203	Road Safety	3	1	0	4	Minor

Course Name	**:**	**Introduction to Environmental Sciences**
Course Code	**:**	**GS 2301 (Common to all branches)**
Credits	**:**	**1**
L T P	**:**	**1 0 0**

Course Objectives:
This course aims to (i) acquaint the students with the basics of Environmental Science (ii) make them aware of the importance of Environmental Science

Total No. of Lectures – 14

Lecture-wise breakup		**No. of Lectures**
Unit 1	Multi-disciplinary Nature of Environmental Studies; Environmental Problems and their Causes, Concept of Sustainability; Sustainable Development, Sustainable Development Goals (SDG).	2
Unit 2	Types of Ecosystems - System Dynamics - Understanding Ecosystems, Ecosystem Degradation, Ecosystem Delivery, Habitat Classification.	2
Unit 3	Natural Resources and Associated Problems, Non Renewable Resources, Renewable Resources, Resource Utilization.	2
Unit 4	Energy and Environment – Fossil Fuel, Geothermal, Tidal, Nuclear, Solar, Wind, Hydropower and Biomass.	2
Unit 5	Environmental Pollution – Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards ; Global Environmental Issues ; Solutions to Pollution Problems.	2
Unit 6	Cleaner Production and Life Cycle Analysis - LCA Methodology, Steps and Tools; EIA and Environment Audit.	2
Unit 7	Environment, Development and Society- Emerging Technologies for Sustainable Development and Environmental Management; Policies and Practices, Legislation; Disaster Management.	2

Course Outcomes (COs): At the end of the course, the students will be able to:	
1	Relate the importance of environmental science for sustainable development of society.
2	Apply the principles of environmental science and the concept of sustainable development in real life engineering problems.

Test Books		**Year of Publication/ Reprint**
S.No.	**Name of Book**	
1	"Environmental Science", Miller G.T. and Spool, Ceonage Learning Publications.	2021
2	"Environmental Studies", Banny Joseph, Tata Mcgraw Hill Publication.	2021
3	"Text book of Environmental Studies for U.G. Courses", Erach Bharucna , University Press.	2021
4	"Environmental Studies – from criteria to cure", R. Raogopalan, Oxford Univ. Press.	2022
5	"Principles of Environmental Science – Inquiry and applications", Mary Ann Cunningham, William P. Cunningham, TMH Edition.	2020

Course Name	**:**	**Geoinformatics**	**DCC**
Course Code	**:**	**CVN301**	
Credits	**:**	**4**	
L – T – P	**:**	**3 – 0 – 2**	

Course Objectives:
At the end of this course, the student should be able to: • To make the students learn the basic concepts of surveying. • To apply the knowledge in the preparation of maps • To appreciate the use of remote sensing and GIS in Civil Engineering practice.

Total No. of Lectures – 42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO SURVEYING AND MAPPING** Principles, generation of maps, Importance, application, conventional and advanced methods	4
Unit 2	**METHODS OF MEASUREMENTS** Compass, Theodolite, Contouring, Plane table	6
Unit 3	**TRAVERSING, TRIANGULATION, CONTOURING, CURVES** Selection of Traverse Station, GALE'S Traverse Table, Calculation of Independent Co-ordinates, Curves, Triangulation	6
Unit 4	**LEVELLING** Basic Definition, Methods of Levelling, Classification of Levelling, Level & Levelling staff, Basic Principles of Levelling	6
Unit 5	**AERIAL PHOTOGRAMMETRY** Basics of Photogrammetry, applications, types, and geometry of aerial photograph, flying height, and scale, Relief displacement.	5
Unit 6	**TOTAL STATION, GPS SURVEYS, DRONE SURVEYS** Introduction to the total station, Advantages of TS, Introduction to GPS surveys, Segments of GPS, Applications of GPS, DGPS, Drone	5
Unit 7	**REMOTE SENSING (RS)** Basic RS, Interaction with atmospheric and earth surface, RS Data Products, Resolution, Applications of Remote Sensing	5
Unit 8	**GEOGRAPHICAL INFORMATION SYSTEM (GIS)** Definition of GIS, Vector and raster data, database creation, Digital Elevation Model (DEM), Applications of GIS	5

List of Experiments		**No. of Turns**
1	Working of Chains, Compass	02
2	Estimation of angular measurements using theodolite	03
3	Estimation of RLs using Levels	03
4	Mapping using handheld GPS	02
5	Mapping using Total Station	04

Course Outcomes (COs): At the end of the course, the students will be able to:	
1	Apply the concepts and analytical methods related to Surveying
2	Use the various surveying equipment.
3	Plan and execute surveying projects

4	Identify the potential use of Remote Sensing and GIS in Civil Engineering

Text Books		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Geomatics Engineering," Arora & Badjatia, Nem Chand & Bros., Roorkee.	2011
2	"Surveying Vol. I & II", B.C. Punmia, A.K. Jain & Jain. Luxmi Publications (P) Ltd., New Delhi.	2006
3	"Remote Sensing & Image Interpretation", Wiley.	2011
4	"Application of Geomatics in Civil Engineers", Ghosh and D.A. Silva, Springer.	2020
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Surveying Vol. II", S.K.Duggal: Tata McGraw Hill, New Delhi.	2009
2	"Surveying and Levelling," Subramanian, Oxford university press.	2012
3	"Surveying and Levelling," N N Basak, McGraw Hill.	2014
4	"Surveying Vol II & III," K.R. Arora, Standard Book House, New Delhi.	2010
5	"Theory and Principles of Geoinformatics", PK Garg, Khanna Publishers	2019
6	"Introduction to UAV", P K Garg, New Age International Publishers.	2021

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://nptel.ac.in/courses/105/104/105104101/ NPTEL video course on Surveying	NPTEL
2	https://nptel.ac.in/courses/105/107/105107122/ NPTEL web course on Surveying	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation

Course Name	**:**	**Structural Analysis - I**	**DCC**
Course Code	**:**	**CVN302**	
Credits	**:**	**4**	
L T P	**:**	**3 0 2**	

Course Objectives :

At the end of this course, the student should be able to:

- Analyze various civil engineering determinate structures subjected to static loading.
- Analyze moving loads on determinate structures.
- Analyze the structures using latest software tools.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**TRAVELLING LOADS** Maximum Shear Force and Bending Moment diagrams for simply supported beams carrying following moving loads: - 1. A single concentrated load 2. Uniformly distributed load 3. Two concentrated loads fixed distance apart 4. Series of concentrated loads Equivalent UDL for bending moment and shear force.	**7**
Unit 2	**INFLUENCE LINES** Influence lines for reactions, BM & SF for simply supported beam. Influence lines for forces in trusses, use of influence lines for calculating design forces due to dead load and moving live loads.	**7**
Unit 3	**ARCHES** Three hinged arches, BM, radial shear and normal thrust at any section of a parabolic and segmental arch due to different static loadings. Moving loads on three hinged arches. Effect of change in temperature.	**6**
Unit 4	**SUSPENSION BRIDGES** Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers.	**4**
Unit 5	**DEFLECTION OF BEAMS** Deflection of determinate beams by double integration method, Macaulay's method, moment area method, conjugate beam method.	**6**
Unit 6	**DEFLECTION OF PERFECT TRUSSES** Deflection of joints in trusses subjected to static loading by Castigliano's strain energy theorem method, Unit load method.	**4**
Unit 7	**SPACE FRAMES** Analysis of space frames by equilibrium method and method of tension coefficients.	**5**
Unit 8	**INDETERMINATE STRUCTURES** Introduction to Indeterminate Structures, Determination of kinematic and static indeterminacy of beams, frames and trusses.	**3**

Course Outcomes:

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

1	Analyze determinate structures for static loads.
2	Analyze determinate structures for moving loads.

3	Determine deflections of various determinate structures
4	Determine indeterminacy of structures.

List of Experiments:		**Number of Turns**
1	To study the behavior of axially loaded column for various support conditions.	1
2	To determine the carryover factor for a beam.	1
3	Verification of Maxwell Reciprocal theorem.	1
4	To determine the moment required to produce a given rotation at one end of the beam for fixed and pinned ends.	1
5	To study the behavior of portal frame under different loading conditions.	1
6	To determine the flexural stiffness beams.	1
7	To study the behavior of 2 hinged and 3 hinged arches.	2
8	Introduction to software and its commands.	3
9	To analyze a building frame using software.	3

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Theory of Structures (Vol. II)", B C Punmia, Laxmi Publications.	2017
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Structural Analysis", R.C. Hibbeler, Prentice Hall of India Pvt. Ltd.	2021
2	"Structural Analysis", T.S. Thandavamoorthy, Oxford University Press.	2011
3	"Theory of Structures", S. Ramamrutham & R. Narayan, Dhanpat Rai.	2014

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/105/105105166/)Structural Analysis I, IIT Kharagpur	NPTEL
2	(https://archive.nptel.ac.in/courses/105/101/105101086/)--- Structural analysis , IIT Bombay	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

Course Name	**:**	**Fluid Mechanics**	**DCC**
Course Code	**:**	**CVN303**	
Credits	**:**	**4**	
L – T – P	**:**	**3 – 0 – 2**	

Course Objectives: The Students should be able to;
At the end of this course, the student should be able to: • Understand the behavior characteristics of fluids. • Apply conservation of mass and conservation of momentum expression for fluid in motion. • Analyze the viscous and non viscous flow. • Develop dimensional relationships between flow variables.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Properties of fluids - Viscosity, Capillarity, Surface Tension, Compressibility, Types of fluids, Continuum principle.	2
Unit 2	**FLUID STATICS** Pascal's law of measurement of pressure, Manometers and gauges, Types of forces on a fluid system, Hydrostatic Forces on subsurfaces, Buoyancy, Stability of floating and submerged bodies.	6
Unit 3	**FLUID KINEMATICS** Lagrangian and Eulerian methods, Types of fluid flow, Typesof flow lines, Description of properties in a moving fluid, Local and convective acceleration, Laplace equation, Stream function, Velocity potential, stream function and flow-nets, Circulation and Vorticity	6
Unit 4	**FLUID DYNAMICS** System and control volume approaches, Equation of conservation of mass, Differential form of continuity equation, Euler's equation of motion in Cartesian Coordinates, Bernoulli's equation and application, Linear momentum and angular momentum equations and their applications.	6
Unit 5	**FLOW MEASUREMENT** Venturimeter, Orifice meter, Pitot tube, Orifices, Mouth pieces, Notches, Weirs, Current meter.	4
Unit 6	**VISCOUS FLOW** Pressure gradient in steady uniform flow, Flow between parallel plates, Qualitative aspects of viscous flows, Hagen-Poiseuille's flow, Transition from laminar to turbulent flow, Turbulent flow in circular pipe,	5
Unit 7	**DIMENSIONAL ANALYSIS AND SIMILITUDE** Buckingham-pi Theorem, Non-dimensional groups, Dimensionless numbers, Geometric, kinematic, and dynamic similarity, Similitude.	4
Unit 8	**FLOW THROUGH PIPES** Laminar flow through pipes, Darcy-Weisbach equation, Moody's diagram, Energy and hydraulic grade line, Head losses in pipes and pipe fittings, Pipes in series and parallel, Hardy-Cross method.	5
Unit 9	**DRAG AND LIFT** Streamlined and bluff body, Types of drag, Drag on a sphere, flat plate, cylinder and airfoil, Development of lift on immersed bodies - circular cylinder and airfoil.	4

List of Experiments		No of turns
1	Basic Introduction to Experiments	**4**
2	Experimental analysis of stability of Floating Bodies.	**2**
3	Determination of Discharge coefficient of a Venturimeter	**2**
4	Determination of Discharge coefficient of a Orificemeter	**2**
5	Determination of C_v, C_c and C_d for an orifice	**2**
6	Determination of friction factor in pipe flow	**2**
7	Experimental determination of head loss in sudden expansion, contraction and due pipe bend	**4**
8	Drawing flow nets	**2**
9	Determination of Discharge coefficient in V Notch	**2**
10	Verification of Bernoulli's Theorem	**4**
11	Measurement of velocity head with a pitot tube	**2**

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Understand the properties of fluids and their estimation
2	Apply kinematics and dynamics of flow for solving real life engineering problems.
3	Analyze the viscous flows and flow through pipe networks.
4	Formulate dimensional relationship between fluid and flow variables and familiarize with flow measurement techniques.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Introduction to Fluid Mechanics and Fluid Machines", (3rd Edition), Som S.K., Biswas Gautam, McGraw-Hill.	2019
2	"Textbook Of Fluid Mechanics & Hydraulic Machines (6th Edition)", Rajpoot R.K., S.Chand.	2016
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Introduction to Fluid Mechanics (8th Edition)", Fox, R.W. and McDonald, A.T. John Wiley and Sons.	2011
2	"Engineering Fluid Mechanics", Garde, R.J., and Mirajgaoker A.G., Scitech Publications.	2010
3	"Fluid Mechanics (4thEdition)", Cengel, Y. A., and Cimbala, J. M., McGraw-Hill.	2019
4	"Fluid Mechanics (9th Edition)", Streeter V.L., Benjamin, W.E., and Bedford, K. W., McGraw-Hill.	2010

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by

1	https://nptel.ac.in/courses/105/103/105103192/-	NPTEL
2	https://nptel.ac.in/courses/105/101/105101082/ -	NPTEL
3	https://nptel.ac.in/courses/105/103/105103095/	NPTEL
4	https://nptel.ac.in/courses/105/105/105105203/	NPTEL
5	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-060-engineering-mechanics-ii-spring-2006/lecture-notes/	MIT Open Course Ware

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

Course Name	**:**	**Building Materials and Building Construction**	**DCC**
Course Code	**:**	**CVN304**	
Credits	**:**	**4**	
L T P	**:**	**3 0 2**	

Course Objectives:
At the end of this course, the student should be able to: • understand different materials used for building construction and their properties. • Perform quality tests for different building materials. • Identify various construction techniques for building components.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**STONE, BRICKS AND TIMBER** Stones: Introduction, quarrying, classification, requirements of good building stone, testing and applications. Bricks: Introduction, manufacturing of bricks, classification, defects, testing and applications. Introduction to timber and seasoning of wood, defects in wood.	9
Unit 2	**BRICK MASONRY** Terminology, bonds in brick masonry. hollow block masonry, types of walls, viz., load bearing and non-load bearing walls.	4
Unit 3	**LIME CEMENT AND CONCRETE** Manufacturing of cement, hydration of cement, classification of cement, testing, application, introduction of lime and its applications. concrete: Introduction, characteristics and classification of aggregates, admixtures, classification of different grades of concrete, applications, properties of fresh and hardened concrete, testing of concrete.	10
Unit 4	**DAMP PROOFING** Causes of dampness in buildings, ill effects and remedial measures, methods of damp proofing.	3
Unit 5	**DOORS, WINDOWS, LINTEL AND ARCHES** Terminology, types of doors and windows, types of lintel and arches.	4
Unit 6	**ROOFS, ROOF COVERINGS AND FLOORS** Terms used, R.C.C. And wooden roofs, pitched and sloping roofs, trussed roofs, roof covering materials. Types of floorings and their construction details.	7
Unit 7	**STAIRS AND STAIRCASES** Terms used, different types of staircases, proportioning, doglegged, half-turn and quarter turn stairs.	3
Unit 8	**FINISHING WORKS AND SCAFFOLDING** Plastering and pointing, painting and distempering, introduction to scaffolding.	2

List of Experiments:		**Number of Turns**
1	To determine fineness and specific gravity of cement.	01
2	To determine standard consistency of cement.	01

3	To determine initial and final setting time of cement.	02
4	To determine soundness of cement.	01
5	To examine water absorption and efflorescence in brick.	02
6	To determine the compressive strength of brick.	01
7	Determination of tensile and compressive strength of steel.	02
8	To carry out sieve analysis of coarse and fine aggregates and to find fineness modulus.	02
9	To determine specific gravity of coarse and fine aggregates.	02

Course Outcomes: At the end of this course, the student will be able to:	
1	Select the appropriate building materials for a particular civil engineering structure.
2	Perform quality tests on different building materials.
3	Understand the construction procedure of different building components.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Building Construction Punmia B.C, Arun Jain & Ashok Jain, "Building Construction" Eleventh Edition, Laxmi publication	2016
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Building Construction", Rangwala, Charotar Publishing House Pvt. Ltd	2016
2	"Building Materials," P.C. Varghese, PHI Learning Pvt Ltd.	2015
3	"Building Technology," S.S. Bhavikatti, Vikas Publishing House Pvt. Ltd.	2013
4	"Building Materials," S.K. Duggal, Fifth Edition, New Age International Publishers.	2019
	Relevant IS codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://nptel.ac.in/courses/105103093)---Construction Planning and Management, IIT Guwahati.	NPTEL
2	(https://archive.nptel.ac.in/courses/105/102/105102088)--- Building material & construction	NPTEL

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

1 – Slight (Low) Correlation
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Course Name	**:**	**Transportation Engineering**	**DCC**
Course Code	**:**	**CVN305**	
Credits	**:**	**4**	
L-T-P	**:**	**3 – 0 – 2**	

Course Objectives:
To make the students learn the basic aspects of road infrastructure including planning,design and maintenance. • To understanding of highway planning and development, • To analyze the geometry design of highways • To analyze the traffic studies and analysis • To analyze the pavement design and analysis, highway material, drainage, bridges, and maintenance

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Highway planning - basic principles, road development and planningin India; Highway alignment and Surveys	4
Unit 2	**GEOMETRIC DESIGN OF HIGHWAYS** Design of cross-section elements, sight distances, design ofhorizontal and vertical alignments	6
Unit 3	**TRAFFIC STUDIES** Traffic studies and their presentation, PCU and axle load survey, Capacity and Level of service, highway safety measures	8
Unit 4	**HIGHWAY MATERIALS** Aggregates and their characterization, Bituminous materials, tests on Aggregates and Bituminous materials	4
Unit 5	**HIGHWAY CONSTRUCTION** Construction Procedure forWBM, Bituminous Bound macadam and Cement Concrete roads	4
Unit 6	**PAVEMENT DESIGN** Classification of pavements and factors affecting design; Design methods of flexible pavements and of Rigid pavements	7
Unit 7	**HIGHWAY DRAIAGE, HIGHWAY BRIDGE AND HIGHWAY MAINTENANCE** Longitudinal and cross drainage, Surface and subsurface drainage, Types of bridges, components, selection criteria, General causes of pavement failure, failures in flexible and rigidpavements and their maintenance	9

List of Experiment		**No. of turns**
1	Impact Value test on Aggregates	**2**
2.	Specific Gravity of the Aggregates	**2**
3.	Crushing value test of the aggregates	**2**
4.	Flakiness and Elongation test of the Aggregates	**2**
6.	Specific Gravity of the Bitumen	**2**

7.	Softening Point of the Bitumen	**2**
8.	Ductility test of the bitumen	**2**
9.	Penetration test of the bitumen	**2**
10.	CBR value of the soil	**4**
11.	Traffic Volume Study	**4**
12.	Final Evaluation of students	**2**

Course Outcomes: At the end of the course the students will be able to:	
1	Identify the components of highways.
2	Plan, design and execute highway projects.
3	Choose the suitable material for highways, construction and maintenance
4	Realize the importance of traffic studies.

Textbooks:		
Sr. No.	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Highway Materials and Pavement Testing" Khanna S.K., Justo C.E.G. and Veeraraghavan A., New Chand Publications, New Delhi.	2013
2.	"Principles of Transportation Engineering" Khitoliya R. K. and Gupta P. K, Dhanpat Rai Publishing, New Delhi.	2017
Reference Books:		
Sr. No.	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Highway Engineering" Kadiyali L.R., Khanna Publishing, New Delhi.	2019
2.	"Principles & Practices of Highway Engineering" Kadiyali L.R, KhannaPublishers, New Delhi.	2004
3.	"Principles, Practice and Design of Highway Engineering" Sharma S. K. (2014), S.Chand Publication.	2014
Indian Standards:		
Sr. No.	**Code Name**	**Year**
1	IRC:19-2005, Standard Specifications and Code of Practice for Water Bound Macadam https://law.resource.org/pub/in/bis/irc/irc.gov.in.019.2005.pdf	2005
2	IRC:27-2009, Specifications for Bituminous Macadam (First Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.027.2009.pdf	2009
3	IRC:37-2019, Guidelines for the Design of Flexible Pavements (Fourth Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.037.2019.pdf	2019

4	IRC:58-2015, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways(Fourth Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.058.2015.pdf	2015
5	IRC:64-1990, Guidelines for Capacity of Roads in Rural Areas (First Revision)https://law.resource.org/pub/in/bis/irc/irc.gov.in.064.1990.pdf	1990
6	IRC:66-1976, Recommended Practice for Sight Distance on Rural Highwayshttps://law.resource.org/pub/in/bis/irc/irc.gov.in.066.1976.pdf	1976
7	IRC:73-1990, geometric design standards for rural (non-urban) highways https://law.resource.org/pub/in/bis/irc/irc.gov.in.073.1990.pdf	1990
8	IRC:86-2019, Geometric Design Standards for Urban Road sand Streets https://law.resource.org/pub/in/bis/irc/irc.gov.in.086.2018.pdf	2019

Equivalent MOOC courses

Sr. No	Course link	Offered By
1	https://nptel.ac.in/courses/105105107 "Transportation Engineering"	**NPTEL**
2	https://nptel.ac.in/courses/105101087 "Transportation Engineering 1"	**NPTEL**

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

1 - Slight(low) Correlation
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Course Name	**:**	**Reinforced Concrete Design-I**	**DCC**
Course Code	**:**	**CVN401**	
Credits	**:**	**4**	
L T P	**:**	**3 0 2**	

Course Objectives:
At the end of this course, the student should be able to: • Conduct quality tests on concrete and constituent materials of concrete. • Design various RCC structural elements and assess their performance. • Design various types of RC foundations.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**PROPERTIES OF CONCRETE** Materials for concrete and their properties, concrete as composite material, properties of concrete in fresh and hardened state, workability, strength and durability, factors affecting workability, strength and durability, Indian Standard method of proportioning concrete mixes.	6
Unit 2	**REINFORCED CONCRETE** Design philosophies, Working Stress method, Ultimate load method and limit state method of design, characteristic strength, Design Loads, characteristic load, design values and partial safety factors, stress strain relationship for concrete and steel.	3
Unit 3	**DESIGN AND DETAILING OF BEAMS** Singly reinforced beams, modes of failure, moment of resistance and design of beams for flexure, analysis and design of doubly reinforced and flanged beams. Shear, bond, torsion. Limit state of serviceability, control of cracking, deflection and vibrations, design of continuous beams by co-efficient method as per IS code.	8
Unit 4	**DESIGN AND DETAILING OF SLABS** One-way slabs, two way slabs, continuous slabs.	5
Unit 5	**DESIGN OF COLUMNS** Types of columns, formulation of interaction charts, design of short columns, columns with helical reinforcement.	8
Unit 6	**FOUNDATIONS** Design of isolated and combined rectangular footings, design concepts of strip and raft foundation, design of masonry walls and their footings	7
Unit 7	**STAIRCASES** Design of different type of stairs.	5

List of Experiments:		**No. of Turns**
1	To determine compressive strength of cement.	2
2	To determine bulk density and voids of fine and coarse aggregates.	2
3	To determine workability of concrete.	1
4	To design concrete mixes.	3
5	To determine split tensile strength of concrete.	2
6	To determine flexural strength of concrete beam specimens.	2
7	To assess the quality of concrete by conducting Rebound hammer Test.	1
8	To assess the quality of concrete by conducting UPV Test.	1

Course Outcomes: At the end of the course the students will be able to:	
1	Assess the quality of concrete and concrete-making materials and design concrete mixes ensuring compliance with Indian standard codes and industry best practices.
2	Design Reinforced Concrete beams, slabs, columns and staircases that meet structural requirements and safety standards.
3	Design various types of RCC foundations.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Reinforced Concrete Limit State Design" A.K.Jain, Nem Chand and Bros.	2012
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Reinforced Concrete Design", S.U. Pillai & Devdas Menon' Tata McGraw Hill Publications.	2005
2	"Plain & Reinforced Concrete (Vol. I & Vol-II)", Jain & Jai Krishan, Nem Chand and Bros.	2007
3	"Limit State Design of Reinforced Concrete", Punmia and Jain (Vol.II), Laxmi Publications.	2007
4	IS:456-2000 "Code of Practice for Plain and Reinforced Concrete Design", BIS Publication.	2000
5	"Concrete Technology", M. L. Gambhir, Tata McGraw Hill.	2017
6	Relevant IS codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/105/105105105/)---Design of Reinforced Concrete Structures, IIT Kharagpur	NPTEL
2	(https://nptel.ac.in/courses/105105104)--- Design Concrete Structures, IIT Kharagpur	NPTEL

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

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Course Name	**:**	**Structural Analysis - II**	**DCC**
Course Code	**:**	**CVN402**	
Credits	**:**	**3**	
L T P	**:**	**3 0 0**	

Course Objectives:
At the end of this course, the student should be able to: • Analyze various civil engineering indeterminate framed structures. • Analyze various civil engineering indeterminate trussed structures. • Analyze the structures using matrix methods.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**SLOPE DEFLECTION METHOD** Derivation of general slope deflection equation, its application to statically indeterminate beams, portal frames with and without sway, yielding of supports.	5
Unit 2	**MOMENT DISTRIBUTION METHOD** Introduction, stiffness factor, carry over factor, distribution factor, application to indeterminate beams, portal frames with and without sway, yielding of supports.	6
Unit 3	**ANALYSIS OF FRAMES** Approximate analysis of frames by Portal method, Cantilever method and Substitute frame method. Introduction to analysis of frames by using software.	6
Unit 4	**INDETERMINATE TRUSSES** Method of least work, Castigliano's 2nd theorem-its derivation and application, Analysis of plane indeterminate trusses, forces in various members of a plane redundant truss due to lack of fit of members.	7
Unit 5	**TWO HINGED ARCHES** Analysis of parabolic arch with secant variation of moment of inertia. Influence lines for different parameters, reaction locus and its application, effect of temperature, yielding of supports.	6
Unit 6	**MATRIX METHODS** Introduction to stiffness and flexibility method, application of flexibility method to beams, application of stiffness method to beams.	8
Unit 7	**FINITE ELEMENT METHOD** Introduction, Basic principle, discretization, Convergence criteria, Applications.	4

Course Outcomes: At the end of the course the students will be able to:	
1	Analyze various indeterminate structures using classical methods.
2	Analyze beams using matrix methods.
3	Analyze the behavior of structures experimentally.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Theory of Structures", B C Punmia (Vol. II), Laxmi Publications.	2017
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Matrix Analysis of Framed Structures", Gere and Weaver, CBS Publishers and Distributors, Delhi-110032.	2004
2	"Advanced Structural Analysis", Ashok K. Jain, Nem Chand &b Bros.	2015
3	"Structural Analysis", T.S. Thandavamoorthy, Oxford University Press.	2011
4	"Structure Analysis: A Matrix Approach", G. Pandit, S. Gupta Tata McGraw Hill Publications.	2008

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/101/105101086/) Structural Analysis II, IIT Bombay	NPTEL
2	(https://archive.nptel.ac.in/courses/105/106/105106050/) Structural Analysis, IIT Madras	NPTEL

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

1 – Slight (Low) Correlation
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Course Name	**:**	**Soil Mechanics**	**DCC**
Course Code	**:**	**CVN403**	
Credits	**:**	**4**	
L - T - P	**:**	**3 – 0 – 2**	

Course Objectives:
The students should be able to: • Understand the formation of soil, classification and its properties. • Formulate and analyze engineering behaviour. • Analyze development of stresses in the soil in the field situation. • Explore the causes of failure in the soil.

Total No. of Lectures – 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**INTRODUCTION TO SOIL** Origin and formation of soils, types of soil, various soil deposits in India and their Characteristics. Identification and classification of soils; 3-phase system of soils particle size and plasticity of soils, limit of consistency and their determination, I.S. Soil classification system, weight, volume and unit weight relationships and their inter-relationships.	5
Unit 2	**SOIL STRUCTURE AND CLAY MINERALS** Introduction to Clay minerals, Basic concepts of soil structure and clay minerals, Clay Particle interaction, Soil Structure and Fabrics, Clay Water System, Clay Shapes and Surface area.	3
Unit 3	**COMPACTION** Compaction, Factors affecting Compaction, Standard and Modified Proctor's Test, Moisture-density relationship, Field Control of Compaction, field and laboratory compaction devices and their suitability of compaction process, effects of compaction on properties of soils.	5
Unit 4	**STRESS DISTRIBUTION** Concept of Total Stress, Effective Stress and Pore water Pressure, **S**tress below point load (Bousinessq's and Westergaard's equations), stresses below uniformly loaded circular and rectangular areas (exact method), approximate methods – point load method, Newmark's chart.	4
Unit 5	**CONSOLIDATION** Compressibility, Factors affecting compressibility, Consolidation, Terzaghi's 1-D consolidation theory, Time Factor, Degree of Consolidation, Predicting settlements and time rates, Consolidation tests, , Square root time fitting method and logarithmic time fitting methods, pre-consolidation pressure and over consolidation ratio, NC and OC Clays, Secondary consolidation.	7
Unit 6	**PERMEABILITY** Permeability; factors affecting permeability; Darcy's law, Laboratory tests and their suitability, Field method for determination of Permeability, flow nets for confined and unconfined flows, effective stress under hydrodynamic conditions, Seepage Pressure, quick sand condition, Filters, and Drains.	6

Unit 7	**SHEAR STRENGTH** Concept of shear strength in soils, Mohr's stress circle, Coulomb's failure envelope, stage of failure and plane of failure, cohesion intercept, angle of shearing resistance, shear strength equation in terms of principal stress, measurement of shear strength of soils by direct shear test, triaxial compression tests, unconfined compression test, vane shear test and presentation of their results. Performing shear strength tests under different drainage conditions (drained, undrained, and consolidated undrained), basic features of triaxial compression test apparatus, pore water pressure parameters. Sensitivity of clays, Thixotropy and critical void ratio.	6
Unit 8	**EARTH PRESSURE** Concept of Lateral Earth Pressure, Active and Passive Earth Pressure, Rankine's Theory and Columb's theories, effect of surcharge loading, water table fluctuations and soil stratification, computation of total lateral thrust and location of resultant earth pressure on earth retaining wall, estimation of depth of unsupported vertical cut in Cohesive backfills. Design consideration of earth retaining structures	6

List of Experiments:		**Number of Turns**
1	To determine grain size distribution by Sieve analysis.	1
2	To conduct Specific gravity test by Pycnometer.	1
3	To determine In-situ density using Sand Replacement method.	1
4	To determine the relative density of soil.	1
5	To determine the field Density test of soil by Core Cutter Method.	1
6	To Determine Liquid limit and Plastic limit.	1
7	To Determine shrinkage limit.	1
8	To determine coefficient of permeability by falling head method.	1
9	To determine coefficient of permeability by constant head method.	1
10	MDD and OMC by Standard Proctor compaction test.	1
11	To determine shear strength parameters by Direct Shear Test.	1
12	To perform Unconfined Compression Test.	1
13	Demonstration of Tri-axial Shear Test.	2

Course Outcomes: By the end of this course, the student will be able to:	
1	Characterize and classify soils.
2	Identify and analyze the properties of soil governing its behaviour.
3	Apply the principles of soil mechanics in the design of earth retaining structures.
4	Perform failure analysis of structures under shear failure and excessive settlement.

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Basic and Applied Soil Mechanics," Gopal Ranjan & A.S.R. Rao. New Age International Publishers.	2006
2.	"Soil Mechanics and Foundations," Muni Budhu, John Wiley & Sons.	2010

Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Principles of Geotechnical engineering," Braja M. Das, Cengage Learning, New Delhi.	2009
2.	"Soil Mechanics," T. William Lambe & Robert V. Whitman, John Wiley & Sons, NY.	2008
3.	Soil Engineering," Alam Singh, CBS Publishers, New Delhi.	2009
4.	"Soil Mechanics in Engineering Practice," Terzaghi and Peck, John Wiley and Sons, New Jersey.	1948

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/105/105/105105168/ NPTEL video course on Geotechnical Engineering	NPTEL
2.	https://nptel.ac.in/courses/105/103/105103097/ NPTEL web course on Soil Mechanics	NPTEL
3.	https://nptel.ac.in/courses/105/106/105106142/ NPTEL web course on Geotechnical and Foundation Engineering	NPTEL
4.	https://nptel.ac.in/courses/105/101/105101201/ NPTEL video course on Geotechnical Engineering	NPTEL

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

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Course Name	:	Irrigation Engineering and Open Channel Hydraulics	DCC
Course Code	:	CVN404	
Credits	:	3	
L – T – P	:	3 0 0	

Course Objectives:
The student should be able to

- Understand concept of free surface flow.
- Apply principles of mass conservation and momentum conservation in open channel flow.
- Distinguish between rigid boundary and mobile boundary channel.
- Assess the crop water requirements and identify suitable irrigation system for command area.

Total No. of Lectures – 42

Lecture wise breakup		No. of Lectures
Unit 1	**INTRODUCTION TO FREE SURFACE FLOWS** Comparison between open channel flow and pipe flow, Types of Channels, Classification of flows, Velocity distribution, Pressure distribution, and Basic governing equations of open channel flows.	3
Unit 2	**UNIFORM FLOW** Establishment of uniform flow, Basic resistance equations in channel flow, Variation of roughness coefficient, Velocity and shear stress distribution, Conveyance of Channel, Section factor and normal depth computation, most efficient channel section, Maximum discharge and maximum velocity in channels.	4
Unit 3	**CRITICAL FLOW** Specific energy in an open channel, Properties of critical flow, Computation of critical depth, Hydraulic exponent for critical depth computation, Application of specific energy concepts.	3
Unit 4	**GRADUALLY VARIED FLOW** Governing equations, Classification and characteristics of water surface profiles and channel slopes, Computations of GVF profiles in prismatic channels.	3
Unit 5	**RAPIDLY VARIED FLOW** Momentum equation formulation for the jump, Specific force diagram, Hydraulic jump and its types, Characteristics of hydraulic jump in a horizontal rectangular channel, Loss of energy in hydraulic jump,	3
Unit 6	**UNSTEADY FLOW** Saint-Venant Equations, Gradually varied unsteady flows, Uniformly progressive wave, Rapidly varied unsteady flows – positive and negative surges.	3
Unit 7	**CROP WATER REQUIREMENTS** Classes and availability of soil water, Available moisture depth, Frequency of irrigation, Relationship betweenduty, delta and base period, Factors affecting duty, Methods of improving duty, Irrigation efficiencies, Command areas, Kharif, rabi and perennial crops, Crop rotation, Irrigation water requirement, Consumptive use.	3
Unit 8	**IRRIGATION METHODS** Types of irrigation schemes, Flooding methods, Border strip method, Check basin and furrow method, Assessment of irrigation water, Sprinkler	3

	irrigation and its design, Drip irrigation and its design.	
Unit 9	**CANAL IRRIGATION** Components of canal distribution system, Alignment and losses of channels, Kennedy's and Lacey's theories and design procedure, Garrets and Lacey's diagrams, Canal lining and design of a lined canal.	3

List of Experiments		**No of Lectures**
1	Basic Introduction to Experiments	4
2	Estimation of Manning's and Chezy's roughness coefficient in open channel flow	2
3	Analysis of Hydraulics of Broad Crested Weir	2
4	To Determine the Elements of a Hydraulic Jump	2
5	Analysis of Flow over a Hump in open channel flow	2
6	Verification of Stokes's Law	2
7	Seepage analysis	4
8	Estimation of Soil moisture using Thiessen polygon	4
9	Drawing the Details of Bhakra Nangal Dam in Drawing sheets	6

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Formulate mathematical expression of open channel flow.
2	Analyze the flow patterns in open channels.
3	Design the rigid and mobile boundary channels.
4	Design the canal irrigation system for estimated crop water requirement of command area.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Open-channel hydraulics", Chow, V. T., The Blackburn Press.	2009
2	"Flow in open channels (5th Edition)", Subramanya, K., McGraw-Hill Education.	2019
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Flow through open channel", Ranga Raju, K. G., McGraw-Hill Education.	2013
2	"Open Channel Flow (3rd Edition)", Chaudhry M. Hanif, Springer.	2022
3	"Flow Through Open Channels", Srivastava Rajesh., Oxford University Press India.	2008
4	"Irrigation and Water Resources Engineering", Asawa, G. L., New Age International, New Delhi.	2014
5	"Irrigation Engineering and Hydraulic Structures" Garg, S. K., Khanna Publishers, New Delhi.	2011

Equivalent MOOCs courses

Sr. No.	Course Links	Offered by
1.	https://nptel.ac.in/courses/105/107/105107059/- Web Course on 'Advanced Hydraulics'	NPTEL
2.	http://www.nptelvideos.in/2012/11/hydraulics.html- Video Course on 'Hydraulics'	NPTEL
3.	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-060-engineering-mechanics-ii-spring-2006/lecture-notes/-	MIT Open Course Ware
4.	https://nptel.ac.in/courses/105/105/105105110/ - 'Water Resources Engineering'	NPTEL
5.	http://www.nptelvideos.in/2012/11/water-resources-engineering.html	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

Course Name	**:**	**Environmental Engineering I**	**DCC**
Course Code	**:**	**CVN405**	
Credits	**:**	**3**	
L - T - P	**:**	**3-0-0**	

Course Objectives:
The student should be able to • compare raw water quality characteristics from different sources • plan and design water treatment scheme • imbibe the fundamentals of water distribution networks and their design • identify causes of air pollution and strategies for mitigation

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Components of water supply scheme, Water demand, Population forecasting methods	4
Unit 2	**WATER QUALITY** Drinking Water Quality Standards	6
Unit 3	**SOURCES OF WATER** Surface Water: Intakes for collecting surface water- types and location; Ground water: Aquifer, aquiclude, movement of ground water and its velocity, yield of wells; Infiltration wells & galleries. Quality comparison of water from different sources	8
Unit 4	**TRANSPORTATION AND PUMPING OF WATER** Various types of Pipes, Materials, Joints Various types of Pumps	4
Unit 5	**WATER TREATMENT** Aeration, Sedimentation – Type I & II, Coagulation Flocculation, Filtration, Disinfection, Specific treatment.	10
Unit 6	**WATER DISTRIBUTION SYSTEM** Components and Design, Various Layouts	5
Unit 7	**AIR** Composition and properties of air, Air pollution, Urban air pollution automobile pollution, Chemistry of combustion, Air quality standards, Control measures for Air pollution.	5

Course Outcomes: By the end of this course, the student will be able to:	
1	Analyze and interpret quality parameters of water
2	Identify the process design aspects of water supply
3	Design water distribution system
4	Describe the strategies to control air pollution

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Environmental Engineering", H.S. Peavy, D.R. Rowe, G. Tchobanoglous, McGraw Hill, NY.	1985
2.	"Manual on Water Supply and Treatment", CPHEEO, MOUD.	1999
	"Environmental Engineering: Fundamentals and Application", S.Verma, V. Kanwar, S. John, Routledge, Taylor and Francis group	2022
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Water Works Engineering", S.R. Qasim, E.R. Motley, G. Zhu , PHI (EEE Edition), New Delhi.	2010
2.	"Water and Wastewater Technology", Hammer & Hammer, Prentice Hall of India.	2008
3.	"Introduction to Environmental Engineering", P.A. Vesilind, S.M. Morgan, Thomson Books, NY.	2011
4.	IS: 10500. Drinking water specifications	2012

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/105/105/105105201/ - Water Supply Engineering	NPTEL
2.	https://nptel.ac.in/courses/105/107/105107207/ - Water and Wastewater Treatment	NPTEL

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

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Course Name	**:**	**Railway, Airport & Tunnel Engineering**	**DCC**
Course Code	**:**	**CVN406**	
Credits	**:**	**3**	
L-T-P	**:**	**3 – 0 – 0**	

Course Objectives :

At the end of the course the students will be able to:

- Students should be able to relate their understanding of the railroad industry, history, and principal components
- To analyze and design the components of railways.
- To know the basic components of airport, analyses and design them
- To know the tunneling systems, drainage and ventilation.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
A. Railways		
Unit 1	**INTRODUCTION** Indian Railways system, gauges, comparison of gauges, advantages of ungauged system, Ideal permanent way, Components of permanentway: Rails, Sleepers and Ballast.	3
Unit 2	**GEOMETRIC DESIGN** Geometric Design of the Railway Track, Curve, Cant, Cant deficiency	3
Unit 3	**POINTS AND CROSSING** Layout plans of simple crossovers, turnouts, diamond crossing, design aspects.	3
Unit 4	**STATIONS AND YARDS** Site selection, different types of stations and their layout, junctions and terminals, marshalling yards, level crossing	3
Unit 5	**PERMANENT WAY CONSTRUCTION & MAINTENANCE** Laying of tracks, Joints and fixtures, Creep, Maintenance	2
Unit 6	**SIGNALLING & INTERLOCKING** Objectives, different types of signals and their location in station yards, interlocking, requirements of interlocking system.	3
B. Airports		
Unit 7	**INTRODUCTION** Classification of airports, Aircraft characteristics, regulatory bodies, Terminology, Air travel demand forecasting, air traffic control systems	3
Unit 8	**AIRPORT PLANNING** Site Selection, Requirements, Zoning laws, Types of runway patterns, Runway layout conditions, length and width, Wind rose diagram, runway orientation, clearance, apron area, Taxiways, Airport capacity, Terminal area, Hangers, Airport markings, Lighting	3
Unit 9	**AIRPORT PAVEMENT DESIGN** Airport Pavement Design, Factors affecting pavement thickness, methods for flexible and rigid pavements	4
Unit 10	**AIRPORT MAINTENANCE AND REHABILITATION** Types of failures in air field pavements, pavement evaluation, repair techniques, design of overlays	3

Unit 11	**AIRPORT DRAINAGE** Surface and subsurface drainage, Runoff estimation, Structures, and materials for drainage	3
C. Tunnel Engineering		
Unit 12	Introduction, types of tunnels, Advantages, Disadvantages, Shapes of tunnel lining, Tunnel Lining materials	3
Unit 13	Soil classification and tunneling methods (Basic description only), drainage of tunnel, tunnel ventilations and dust.	6

Course Outcomes	
1	Know the history of development of railways.
2	Understand the working and design of different elements of railway track.
3	Understand the airport planning and design of various components for efficient development of airports
4	Get familiar with tunnelling systems.

Textbooks:

Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Airport Engineering: Planning & Design" Saxena S.C., CBS Publishers.	2019
2.	"A Textbook of Railway Engineering" Saxena S.C. and Arora S. P. , Dhanpat Rai and Sons, New Delhi.	2010
3.	"Principles of Railway Engineering" Rangwala S.C., Charotar Publishing House.	2015

Reference Book:

Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Airport Planning and Design" Jain S.S., Arora M.G. and Khanna S. K., NemChand and Bros.	1999
2.	"Railway Engineering" Chandra S. and Agarwal M.M., Oxford University Press,New Delhi.	2013
3	IRC:39-1986, Standards for Road-Rail Level Crossings (First Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.039.1986.pdf	1986
4	IRC:76-1979, Tentative Guidelines for Structural Strength Evaluation of Rigid Airfield Pavements https://law.resource.org/pub/in/bis/irc/irc.gov.in.076.1979.pdf	1979
5	IRC105:2019, Specifications for Dense Bituminous Macadam and Bituminous Concrete for Airfield Pavements (First Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.105.2019.pdf	2019

Equivalent MOOC courses

Sr. No	Course link	Offered By
1	https://nptel.ac.in/courses/105/107/105107123/ 'Introduction to airport engineering', 'Introduction to airport engineering'.	NPTEL
2	https://archive.nptel.ac.in/courses/105/105/105105212/ 'Rock Mechanics and tunneling'	NPTEL

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

1 - Slight(low) Correlation
2 - Moderate (Medium) Correlation
3 - Substantial (High) Correlation
"-" indicates there is no Correlation

Course Name	**:**	**Design of Steel Structures- I**	**DCC**
Course Code	**:**	**CVN501**	
Credits	**:**	**3**	
L T P	**:**	**3 0 0**	

Course Objectives:

At the end of this course, the student should be able to:

- Know the basics of limit state design of steel structures, design bolted and welded connections.
- design compression and tension members.
- understand the basics of plastic design and able to design flexural members and laterally restrained beams.
- design steel roof truss.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Introduction to steel and steel structures, Introduction to design, Design loads and load combinations, limit state design, allowable stresses in structural steel.	4
Unit 2	**DESIGN OF BOLTED CONNECTIONS** Terminology, Types of bolted connections, Modes of failure, Design of bolted connections for direct loads, for joints subjected to moment perpendicular to and in the plane of joint.	5
Unit 3	**DESIGN OF WELDED CONNECTIONS** Terminology, Types of welded connections, Modes of failure, Design of welded connections for direct loads, for joints subjected to moment perpendicular to and in the plane of joint	5
Unit 4	**DESIGN OF TENSION MEMBERS** Types of Tension members, strength of tension members, design of tension members, introduction to splicing and lug angles.	5
Unit 5	**DESIGN OF COMPRESSION MEMBERS** Types of compression members, Buckling classes of compression members, design of compression members, design of laced and battened columns.	6
Unit 6	**BASICS OF PLASTIC DESIGN** Introduction to plastic design, Moment curvature relationship, shape factor, plastic hinges, plastic moment of various sections.	4
Unit 7	**DESIGN OF BEAMS** Design of steel beams, web buckling, web crippling, design of built-up beams, laterally supported beams, introduction to torsional buckling.	7
Unit 8	**ROOF TRUSS** Introduction, Types of trusses, Roof coverings, estimation of wind load, design of steel roof truss subjected to dead, live and wind loads.	6

Course Outcomes:

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

1	Understand the design philosophies of steel structures and design the bolted and welded connections of structural steel.

2	Design compression and tension steel members.
3	Understand the basics of plastic design and design of flexural beams.
4	Design steel roof truss.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Limit state design of Steel Structures", S.K. Duggal, Tata McGraw Hill	2017
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Steel Structures: Design and practice", N. Subramanian, Oxford Publishing Press.	2010
2	"Design of Steel Structures", Arya & Awadhesh Kumar, Nem Chand and Bros., Roorkee.	2022
3	"Design of Steel Structures",S.S. Bhavikatti, I.K. International Publishing House Pvt. Ltd.	2012
4	"Design of Steel of Structures", Volume 1 Ram Chandra.S., Virendra Gehlot, , Scientific Publishers, New Delhi.	2016
5	Relevant IS Codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/106/105106112/)---Design of Steel Structures I, IIT Madras	NPTEL
2	(https://archive.nptel.ac.in/courses/105/105/105105162/)---Design of steel structures, IIT Kharagpur	NPTEL

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

1 – Slight (Low) Correlation
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Course Name	**:**	**Reinforced Concrete Design-II**	**DCC**
Course Code	**:**	**CVN502**	
Credits	**:**	**3**	
L T P	**:**	**3 0 0**	

Course Objectives :

At the end of this course, the student should be able to:

- Design specialized RCC structures.
- Design liquid retaining RC structures.
- Design basic PSC structures.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**RETAINING WALLS** Types of retaining walls and their Components, stability criteria, Design and detailing of cantilever and counterfort retaining walls.	7
Unit 2	**BEAMS CURVED IN PLAN** Design of circular beams supported on symmetrically placed columns, semicircular beams supported on equally spaced columns.	4
Unit 3	**DOMES** Types of domes, analysis and design of RCC spherical and conical domes, openings in domes.	4
Unit 4	**LIQUID RETAINING STRUCTURES** Design criteria of liquid retaining structures, Design of tanks resting on ground, underground tanks and design concepts for overhead service reservoirs, its staging and foundation.	6
Unit 5	**INTRODUCTION TO PRESTRESSED CONCRETE** Introduction, materials for prestressed concrete, methods of prestressing.	3
Unit 6	**LOSSES OF PRESTRESS** Losses of Prestress, Loss due to elastic deformation, shrinkage and creep on concrete, relaxation of stress in steel, loss due to friction, anchorage slip, total losses.	4
Unit 7	**ANALYSIS OF PRESTRESS MEMBERS** Basics Assumptions, Analysis of prestress, Pressure Line, kern distance, Concept of Load Balancing, Stresses in Tendons.	6
Unit 8	**LIMIT STATE DESIGN OF PRESTRESSED CONCRETE BEAMS** Types of flexural failure, Design of PSC beams for flexure, shear, torsion and bond, deflection in PSC beams, IS codal specifications.	5
Unit 9	**ANCHORAGE ZONE STRESSES** End blocks, stress distribution in end blocks, transmission length, anchorage zone reinforcement.	3

Course Outcomes:

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

1	Design specialized RCC structures as per IS codal specifications.
2	Design liquid retaining structures, complying to latest IS codes.
3	Analyze and Design basic Prestressed concrete structures as per IS codal specifications.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Reinforced Concrete Limit State Design"' A.K.Jain, Nem Chand and Bros.	2012
2.	"R.C.C. Designs (Reinforced Concrete Structures)" B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications.	2015
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1.	"Plain & Reinforced Concrete", Jain & Jai Krishan (Vol. I & Vol-II), Nem Chand and Bros.	2007
2.	"Reinforced Concrete Structures", Syal and Goel, S. Chand & Company Pvt. Ltd.	2014
3.	"Reinforced Concrete Design", S.U. Pillai & Devdas Menon, Tata McGraw Hill.	2017
4.	"Plain & Reinforced Concrete (Vol. I & Vol-II)", Jain & Jai Krishan, Nem Chand and Bros.	2007
5.	"Design of Prestressed Concrete structures", Lin T.Y., Wiley Interscience, Publication, New Jersey	2010
6.	"Fundamentals of Prestressed Concrete", V Natrajan, B.I. Publications, New Delhi	1983
7.	"Prestressed Concrete", N. Raju Krishna, McGraw Hill Education	2019
8.	"Prestressed Concrete Structures 7Th Edition", Dayaratnam P., Medtech Publisher.	2017
9.	Relevant IS codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/105/105105105/)---Design of Reinforced Concrete Structures, IIT Kharagpur	NPTEL
2	(https://nptel.ac.in/courses/105105104)--- Design Concrete Structures, IIT Kharagpur	NPTEL
3	(https://nptel.ac.in/courses/105106117/) --- Pre-stressed Concrete Structures, IIT Madras	NPTEL

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

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Course Name	**:**	**Environmental Engineering II**	**DCC**
Course Code	**:**	**CVN503**	
Credits	**:**	**4**	
L - T - P	**:**	**3-0-2**	

Course Objectives:
The student should be able to • identify various environmental issues related to wastewater • plan and design wastewater treatment scheme • analyze, design various components of wastewater collection, treatment and disposal • identify various aspects of solid waste management

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Wastewater quantity and quality characteristics	3
Unit 2	**SEWERAGE SYSTEM** components and design, Sewer appurtenances, Conveyance of sewage-Sewer design, Sewage pumping	10
Unit 3	**EFFLUENT DISPOSAL** Disposal on land, disposal in water, D.O. sag curve, self-purification of rivers	3
Unit 4	**WASTEWATER TREATMENT** Wastewater characteristics, preliminary, primary, secondary and tertiary treatment	12
Unit 5	**SLUDGE** Treatment and Disposal	3
Unit 6	**DRAINAGE SYSTEMS** Quantification and design of storm water drains	5
Unit 7	**SOLID WASTE MANAGEMENT** MSW: Components, collection, processing and material recovery, disposal	6

List of Experiments:		**Number of Turns**
1	Solids- total, suspended, dissolved, volatile, fixed	02
2	pH and turbidity	01
3	Acidity and alkalinity	01
4	Hardness	01
5	Jar Test	01
6	Chloride	01
7	Residual Chlorine concentration	01
8	Dissolved Oxygen	01
9	Biochemical Oxygen Demand	01
10	Chemical Oxygen Demand	01
11	Total Kjeldahl Nitrogen	01
12	Bacteriological count / Most Probable Number	01
13	Suspended Particulate Matter	01

Course Outcomes: By the end of this course, the student will be able to:	
1	Analyze and interpret water and wastewater characteristics
2	Interpret wastewater characteristics to plan and design for sewage and sludge treatment
3	Design sewerage system components
4	Design drainage system components
5	Describe the aspects of solid waste management

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Environmental Engineering", H.S. Peavy, D.R. Rowe, G. Tchobanoglous, McGraw Hill, NY.	1985
2.	"Manual on Water Supply and Treatment", CPHEEO, MOUD.	1999
3.	"Environmental Engineering: Fundamentals and Application", S.Verma, V. Kanwar, S. John, Routledge, Taylor and Francis group	2022
4.	"Sewage Disposal and Air Pollution Engineering", S.K.Garg, Khanna Publishers.	2010
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Manual on sewerage and sewage treatment",CPHEEO, MoUD.	2013
	"Manual on storm water drainage systems",CPHEEO, MoUD.	2019
2.	"Water and Wastewater Technology", Hammer & Hammer, Prentice Hall of India.	2008
3.	"Standard Methods for the Examination of Water and Wastewater", AWWA.	2022
4.	"The STP guide : Design, operation & maintenance", A.S. Kodavasal, Karnataka State Pollution Control Board.	2011

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/105/107/105107207/ - Water and Wastewater Treatment	NPTEL

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

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Course Name	**:**	**Hydrology and Hydraulic Structures**	**DCC**
Course Code	**:**	**CVN504**	
Credits	**:**	**3**	
L – T – P	**:**	**3 – 0 – 0**	

Course Objectives:

The students should be able-

- To understand the hydrological processes viz. precipitation and abstractions from precipitation like infiltration, evaporation, and evapotranspiration.
- To understand the concept of runoff, hydrographs, and flood routing
- To apply the basic concepts of hydrology in solving daily life problems related to water resources engineering.
- To understand and analyse the hydraulic structures like diversion and storage head work.

Total No. of Lectures-42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO WATER RESOURCES ENGINEERING** Hydrological cycle, Types of hydrological models, Water-budget equation, Global freshwater resources, Importance and need of water resources projects, Sources of hydrologic data.	2
Unit 2	**PRECIPITATION MEASUREMENT AND ANALYSIS** Precipitation and its forms, Weather systems for precipitation, Measurement of precipitation, Rain gauge network, Hyetograph, and mass curve, Consistency of rainfall data, Infilling missing rainfall records, Areal precipitation, Depth-area-duration curves, Intensity-duration-frequency curves, Probable maximum precipitation.	5
Unit 3	**HYDROLOGIC ABSTRACTIONS** Infiltration, Factors affecting infiltration, Measurement of infiltration, Modelling infiltration capacity, Infiltration indices, Evaporation: its measurement and estimation, Evapotranspiration: its measurement and estimation.	5
Unit 4	**RUNOFF AND HYDROGRAPH** Measurement of stream flow, Area-velocity method, Stage-discharge (rating) curve, Hydrograph, Runoff characteristics of streams, SCS-CN method of estimating runoff volume, Flow duration curve, Factors affecting runoff hydrograph, Components of a hydrograph, Base flow separation, Unit hydrograph – its derivation, conversion, application and limitations, Synthetic unit hydrograph.	7
Unit 5	**FLOOD ESTIMATION AND ROUTING** Methods for peak discharge estimation, Recurrence interval and return period, Flood frequency analysis – Gumbel's method, Flood routing – basic equations and data requirements, Hydrologic storage and channel routing.	5
Unit 6	**DIVERSION HEADWORKS AND CROSS-DRAINAGE WORKS** Components of diversion headwork and their functions, Layout plan, Failure of hydraulic structures on permeable foundations, Bligh's and, Lane's weighted creep theory, Khosla's method of independent variables, Design of weir and barrages on permeable foundation. Types of cross-drainage structure – Aqueduct, Siphon aqueduct, Super passage, Canal siphon, Level crossing, Selection of suitable cross-drainage structure.	8
Unit 7	**STORAGE HEAD WORK** Choice of type of dams, Site selection and investigation, Gravity dams – Forces acting on a gravity dam, Stability analysis of a gravity dam, Elementary and practical profile of a gravity dam, Earthen dams –Components of earthen dams and their functions, Estimation and control of seepage in earthen dam, Failure criteria of an earthen dam, Spillways - Type of spillways, Discharge characteristics of spillways.	10

Course Outcomes (COs): At the end of the course, the students will be able to:	
1	Understand the hydrological processes to estimate precipitation and abstractions.
2	Compute runoff, derive hydrographs, and carry out flood routing.
3	Understand the concepts of Diversion and storage Head Work.
4	Design important hydraulic structures and their components.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Applied Hydrology", Chow, V. T., Maidment, D. W., and Mays, L. W., Tata Mc-Graw Hill Education.	2010
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Irrigation and Water Resources Engineering", Asawa, G. L., New Age International, New Delhi.	2014
2	"Irrigation Engineering and Hydraulic Structures", Garg, S. K., Khanna Publishers, New Delhi.	2011
3	"Irrigation Water Power and Water Resources Engineering", Arora, K. R., Standard Publishers.	2011
4	"Engineering Hydrology", Subramanya, K., Tata Mc-Graw-Hill, New Delhi.	2013

Indian Standards:

Sr. No.	**Code Name**	**Year**
1.	IS: 6512 – 1984 (reaffirmed 1998). Criteria for design of solid gravity dams. Bureau of Indian Standards, New Delhi	1998
2.	IS: 8826 – 1978 (reaffirmed 2002). Guidelines for design of large earth and rockfill dams. Bureau of Indian Standards, New Delhi.	2002
3.	IS: 10635 – 1993 (reaffirmed 1998). Freeboard requirements in embankment dams - Guidelines. Bureau of Indian Standards, New Delhi	1998

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/105/104/105104103/-video course on 'Water Resources Engg'	NPTEL
2.	https://nptel.ac.in/courses/105/101/105101002/-web course on 'Advanced Hydrology'.	NPTEL
3.	https://nptel.ac.in/courses/105/105/105105110/-web course on 'Water Resources Engg.	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

Course Name	**:**	**Foundation Engineering**
Course Code	**:**	**CVN505**
Credits	**:**	**3**
L - T - P	**:**	**3 – 0 – 0**

Course Objectives:

The students should be able to:

- Understand different types of foundations, decide their suitability.
- Design the foundation under static and dynamic load.
- Analyze the stability of slopes.
- Apply the knowledge to improve the ground conditions.

Total No. of Lectures-42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**SITE EXPLORATION** Objects of soil investigation for new and existing structures, soil exploration method with relative merits and demerits, depth and spacing of boreholes, soil sampling, SPT and plate load test, Borehole Logs.	4
Unit 2	**BEARING CAPACITY** Ultimate and allowable bearing pressure, general, local, and punching shear failures, bearing capacity theories, corrections for size, shape, depth, the eccentricity of loading, water table, etc., Presumptive bearing capacities, IS code Method, correlations with SPT.	6
Unit 3	**SHALLOW FOUNDATIONS** Design considerations-factors of safety, allowable settlements, location and depth of foundations, codal provisions, choice of shear strength parameters, total and differential settlement, stress distribution for settlement calculation, consolidation settlement in clays (with correction factors), settlement computation from N-values.	4
Unit 4	**PILE FOUNDATIONS** Types of piles, axial capacity of single piles – dynamic and Static formula, skin friction and end bearing in sands and clays, axial capacity of pile groups, group efficiency, settlement of single piles and groups, negative skin friction, uplift capacity of pile, pile load tests, codal provisions, laterally loaded piles, under reamed piles.	6
Unit 5	**CASSION AND WELL FOUNDATIONS** Types of Caissons, scour depth, parts of the well foundation, design criterion, estimation of allowable bearing pressure, lateral stability of well foundation, well sinking, tilt and shift	5
Unit 6	**SLOPE STABILITY** Finite and infinite slopes, critical failure surface, factor of safety, Swedish circle method, friction circle method, bishop's method, stability number, Taylor's stability chart, stability analysis of earthen dams.	5
Unit 7	**SOIL DYNAMICS AND MACHINE FOUNDATIONS** Engineering problems involving soil dynamics, dynamic loading, theory of vibrations, types of machine foundations, design criteria for machine foundations, codal provisions.	6
Unit 8	**GROUND IMPROVEMENT** Mechanical soil stabilization, mixing additives, grouting, dynamic compaction, Pre-loading with vertical drain, stone column, vibro-flotation, introduction to geosynthetics, reinforced soil.	6

Course Outcomes : By the end of the course, the students will be able to:	
1	Design suitable foundations for different structures under varied field conditions.
2	Analyze the stability of natural and manmade slopes
3	Analyze and design the machine foundations.
4	Improve the ground behaviour as per requirement.

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Analysis and Design of Sub-Structure," Swami Saran, CRC Press.	2006
2.	"Foundation Engineering," P.C. Varghese, PHI Learning Private Limited.	2013
3.	"Principles of Foundation Engineering," B. M. Das, Cengage Learning, New Delhi.	2013
4.	"Soil Mechanics and Foundations," Muni Budhu, John Wiley & Sons.	2010
5.	"Soil Dynamics & Machine Foundation," Saran, S., Galgotia Publication.	2006
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Foundation Analysis and Design," J.E. Bowles, McGraw-Hill. (1996)	1996
2.	"Pile Foundation Analysis and Design" Poulos H.G. and Davis, E. H., John Wiley.	1980
3.	"Geotechnical-Earthquake Engineering," Kramer, S.L., Pearson Education – Indian Low-Price Edition.	2004
4.	"Reinforced Soil and its Engineering Applications," Swami Saran, I.K International Pvt Ltd.	2006
5.	"Soil Dynamics," Prakash, S., McGraw Hill Book Company. (1981)	1981

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://archive.nptel.ac.in/courses/105/105/105105176/NPTEL video course on Foundation Engineering	NPTEL
2.	https://archive.nptel.ac.in/courses/105/105/105105207/NPTEL video course on Advanced Foundation Engineering	NPTEL

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

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DEPARTMENTAL ELECTIVE COURSES-I

Course Name	**:**	**Concrete Technology**	**DEC**
Course Code	**:**	**CEE105**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives :
At the end of this course, the student should be able to: • Understand the structure of concrete. • Design concrete mix. • Understand the use of special concretes. • Evaluate distressed structures and apply retrofitting techniques.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**CONCRETE** Introduction to concrete ingredients like Cement, Aggregates, Chemical Admixtures, Role of Supplementary Cementitious Materials, concrete production, RMC, compaction and curing.	4
Unit 2	**CONCRETE MICROSTRUCTURE** Cement hydration products, microstructure properties of concrete, Interfacial transition zone (ITZ), particle packing, Introduction of analytical techniques to examine microstructure of concrete.	5
Unit 3	**RHEOLOGY OF CONCRETE** Introduction to rheology of concrete, workability of concrete. Yield stress and viscosity of concrete, factors affecting rheology of concrete, testing methods.	5
Unit 4	**CONCRETE MIX DESIGN** General principles, IS codal guidelines, mix design procedure for medium and high strength concrete using various admixtures.	5
Unit 5	**PROPERTIES OF HARDENED CONCRETE** Mechanical and durability properties of concrete and test methods, Creep, Shrinkage.	6
Unit 6	**SPECIAL CONCRETES:** Self compacting concrete, fiber reinforced concrete, geo-polymer concrete, 3D-printed concrete. Introduction to pre-cast technologies.	5
Unit 7	**DETERIORATION AND EVALUATION OF DISTRESSED STRUCTURES** Deterioration: Embedded Metal Corrosion, Disintegration Mechanisms, Moisture Effects, Thermal Effects, Structural Effects, Faulty Construction. Evaluation: Visual Investigation, Destructive Testing Systems, Non-Destructive Testing Techniques, Semi-Destructive Testing Techniques.	6
Unit 8	**REPAIR AND RETROFFITING TECHNIQUES** Selection of Repair Materials, Surface Preparation, Bonding repair Materials to Existing concrete, Placement Methods, Introduction to structural members strengthening techniques.	6

Course Outcomes: At the end of this course, the student will be able to:	
1	Design of different types of concretes.
2	Understand the behavior of conventional and special concretes.
3	Evaluate distressed structures and apply retrofitting techniques.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Concrete-Microstructure, Properties and Materials" P.K. Mehta and P.J.M. Monteiro, McGraw Hill.	2014
2.	"Concrete Repair and maintenance illustrated" Peter H. Emmons, R.S means company INC.	2002
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1.	"Concrete Technology" by A.M. Nevillie and J.J. Brooks.	2019
2.	"Testing of Concrete in Structures," S. Bungey, G. Lillard, and M.G. Grantham, Taylor and Francis.	2006
3.	"Concrete Technology - Theory and Practice," MS Shetty, S. Chand.	2006
4.	"Concrete Repair and Maintenance," PH Emmons, Galgotia Publication.	2012
5.	"Handbook on Non-destructive Testing of Concrete," VM Malhotra and NJ Carino, CRC Press.	2004
6.	Relevant IS codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://nptel.ac.in/courses/105106202)--- Maintenance and Repair of Concrete Structures, IIT Madras	NPTEL
2	(https://archive.nptel.ac.in/courses/105/105/105105213/)--- Retrofitting and rehabilitation of civil infrastructure, IIT Kharagpur	NPTEL

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

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Course Name	**:**	**Multimodal Urban Transportation System**	**DEC**
Course Code	**:**	**CEE106**	
Credits	**:**	**4**	
L – T – P	**:**	**3 – 1 – 0**	

Course Objectives:

To make the students learn about the recent trends in mass transportation system and theanalytical techniques of multimodal transit.

- Identify the sustainability principles in transportation
- Introduce the concept of Travel Demand Management (TDM)
- Disseminate the techniques of urban public transit planning, operations and management
- Imbibe the concepts of non-motorized urban transport
- Demonstrate the applications in intelligent transportation systems (ITS)

Total No. of Lectures – 42

Lecture wise break up		**No. of Lectures**
Unit 1	**OVERVIEW OF URBAN TRANSPORTATION** Urbanization and Transport, Key issues in urban transportation, Challenges in urban transportation, Travel demand modelling overview, Vehicular Level of Service (LOS) overview.	6
Unit 2	**PUBLIC TRANSPORTATION** Introduction to public transportation, Basic operating elements of public transportation, Bus Transportation, Rail transportation, Intermediate Public Transportation, Measuring performance of transit systems.	10
Unit 3	**NON-MOTORIZED TRANSPORTATION (NMT) PLANNING** Introduction to NMT Systems, Non-Motorized Transportation (NMT) Planning, Basic NMT Characteristics, Non-Motorized Transportation (NMT) Planning, Bicycle Facilities and Level of Service (BLOS), Non-Motorized Transportation (NMT) Planning, NMT Design Principles, Design of Pedestrian Infrastructure, Design of Cycling Infrastructure	10
Unit 4	**URBAN TRANSPORT AND SUSTAINABILITY** Introduction to Intelligent Transportation Systems (ITS), ITS components, applications and communication, Public Bicycle Sharing (PBS) System with ITS, Multimodal transportation (MMT) environment, Design of multimodal transfer facilities, Introduction to Pedestrian Road Safety and associated Risk Factors, Sustainable strategies for Urban Transportation, Environmental Concerns of Urban Transport.	12
Unit 5	**TRANSIT ORIENTED DEVELOPMENT (TOD)** Introduction to TOD, Objectives of TOD, Design Principles of TOD, Benefits of TOD	4

Course Outcomes (COs):

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

1	Apply the analytical techniques of multimodal transportation systems in the field.
2	To develop a basic understanding of public transportation system.
3	To understand the Management Issues in Multimodal Transport Planning
4	Understanding of Transportation Planning and Transit Oriented Development.

Textbooks:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Sustainable Mass Transit: Challenges and Opportunities inUrban Public Transportation" Thomas Abdallah, Elsevier.	2017
2.	"Transport Engineering and Planning" Papacostas C.S., Pearson Education India.	2015
Reference Book:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Urban Mass Transit – The Life Story of a Technolog", Robert Post, Johns HopkinsUniversity Press.	2010
2.	"Fundamentals of Intelligent Transportation Systems Planning", Mashrur A. Chowdhury, Adel Wadid Sadek, Artech House, Inc. Boston.	2003
3.	"Sustainable Transport: Planning for Walking and Cycling in Urban Environments", Rodney Tolley, Woodhead Publishing Ltd.	2003

Equivalent MOOC courses

Sr. No	Course link	Offered By
1	https://nptel.ac.in/courses/105/105/105105204/ "Introduction to Multimodal urban transportation systems'.	NPTEL

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

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Course Name	**:**	**Construction Project Management and Economics**	**DEC**
Course Code	**:**	**CEE107**	
Credits	**:**	**4**	
L – T – P	**:**	**3 – 1 – 0**	

Course Objectives:

At the end of the course, the student should be able to learn the basic knowledge of Construction Project Management and Economics-

- To understanding of Construction Management and Bar/ milestone charts
- To analyze the PERT and CPM, CPM (Cost Model),
- To explore construction Equipments and selection of construction equipment
- To apply the concept of CPM updating and Resource allocation

Total No. of Lectures – 42

Lecture wise breakup		**No of Lectures**
Unit 1	**INTRODUCTION** Project Management, Project Planning, Scheduling, Controlling, Method of planning and Programming, bar Charts and Milestone charts and Network Methods/techniques	4
Unit 2	**PERT (PROGRAMME EVALUATION AND REVIEW TECHNIQUE)** Definitions, Time estimates, frequency Distribution, mean ,variance and standard deviation, probability distribution, beta distribution, expected time, time computation, network analysis, critical path	6
Unit 3	**CPM (CRITICAL PATH NETWORK)** CPM Networks, Earliest event time, Latest allowable occurrence time. Earliest start time, earliest finish time, latest start time, latest finish time, float critical activity, critical path	6
Unit 4	**CPM (COST MODEL)** Project cost, direct project cost, indirect project cost, Total Project cost and optimum duration, slope of direct cost curve, steps in time cost optimization.	6
Unit 5	**CONSTRUCTION EQUIPMENT:** Classification of major equipment, Earth excavating equipment, earth cutting and hauling equipment, earth compacting and grading equipment, concreting plant and equipment.	6
Unit 6	**SELECTION OF CONSTRUCTION EQUIPMENT:** Task considerations, data required for updating, equipment engg. considerations, equipment acquisition options.	6
Unit 7	**CPM (UPDATING)** Updating process, data required for updating, steps in process of updating, when to update, PPT/BOT technique and its variance.	4
Unit 8	**RESOURCE ALLOCATION** Resource usage profiles: Histogram, Resources smoothing, Resource levelling, risk associated in construction project management.	4

Course Outcomes (COs): By the end of this course, the student will be able to:	
1	Proficient enough to apply the concepts of the construction project management.
2	Able to understand the concepts of PERT and CPM.
3	To obtain the different cost of the projects with total cost of the project
4	To understand the Selection of construction equipments, CPM updating and Resource

Textbooks:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Project planning and control with CPM/PERT", Dr. B.C. Punmia, Laxmi Publication New Delhi.	2016
Reference Book:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Construction project management", K.K Chitkara, Tata McGraw-Hills.	2015
2.	"Construction equipments", by Mahesh Verma.	2016
3.	"Construction project management and an integrated approach", Peter Femings, Yes Dec Publishing pvt. Ltd. Chennai.	2017

Equivalent MOOC courses

Sr. No	**Course link**	**Offered By**
1	Construction project management and Economics: https://archive.nptel.ac.in/courses/105/104/105104161/	**NPTEL**
2	Construction project management and Economics: https://ocw.mit.edu/courses/1-040-project-management-spring-2009/	**MIT Open Course Ware http://ocw.mit.edu**

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

1 - Slight(low) Correlation
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Course Name	**:**	**Solid Waste Management**	**DEC**
Course Code	**:**	**CEE108**	
Credits	**:**	**4**	
L - T - P	**:**	**3-1-0**	

Course Objectives:
The student should be able to • identify various aspects of solid waste management • characterize various types of wastes • plan and design processing/ treatment practices for different types of wastes • plan and design disposal of wastes

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**SOLID WASTE** Types of solid wastes, Quantity, characteristics, and composition of municipal solid wastes.	8
Unit 2	**SOLID WASTE DISPOSAL** Collection, processing, transport and disposal	8
Unit 3	**ENGINEERED SYSTEMS FOR RESOURCES, ENERGY & MATERIAL RECOVERY** Recovery from Biodegradable wastes, Recovery of Energy from Conversion Products, Material recovery, Recycling and upcycling	12
Unit 4	**LANDFILLS** Site consideration, operation and closure, Leachate: formation, composition, and control	6
Unit 5	**LIFE CYCLE ASSESSMENT** Concepts and Methodology, Sustainability Assessment of SWM-Circular Economy Analysis: concepts and design	4
Unit 6	**LEGISLATION** Relevant rules for the management of various types of wastes	4

Course Outcomes: By the end of this course, the student will be able to:	
1	Describe the functional elements of solid waste management
2	Identify methods for solid waste treatment/ processing
3	Plan and design disposal of wastes
4	Landfill design, closure and handling of leachate

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Environmental Engineering", H.S. Peavy, D.R. Rowe, G. Tchobanoglous, McGraw Hill, NY.	1985
2.	"Integrated Solid Waste Management", G. Tchobanoglous, H. Theisen, S. A. Vigil, Mc Graw Hill International Ed.	1993

Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Manual on Solid Waste Management",CPHEEO, MoUD & GIZ.	2016
2.	"Gazette notifications for various waste management rules".	Latest
3.	"Textbook of Solid Wastes Management", l.H. Khan & N. Ahsan, CBS Publishers.	2012

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/105/106/105106056/ - Solid and Hazardous Waste Management	NPTEL
2.	https://nptel.ac.in/courses/105/103/105103205/ - Municipal Solid Waste Management	NPTEL

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

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Course Name	**:**	**Engineering Geology**	**DEC**
Course Code	**:**	**CEE109**	
Credits	**:**	**4**	
L T P	**:**	**3 0 2**	

Course Objectives:
• To analyze past and prevailing geological process operating on the Earth. • To explore processes of formation of minerals and rocks and their utility to Civil Engineers. • To develop knowledge as to how geological structures affect engineering projects. • To apply the importance of engineering geology in Civil Engineering projects.

Total No. of Lectures- 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**GENERAL GEOLOGY** Physiographic features of India, Branches of Geology and the importance of Engineering Geology; Weathering, erosion, transportation and deposition of Earths material; Landforms associated with processes of erosion, transportation, and deposition in deserts, glaciated regions and river valleys.	10
Unit 2	**STRATIGRAPHY** Principals of Stratigraphy; Standard geological time scale and introduction to the concept of time in geological studies; Introduction to geochronological methods, and economic importance of Archean system, Cuddapah system & Vindhyan system.	6
Unit 3	**STRUCTURAL GEOLOGY** Stratification, dip, strike, and unconformities; Folds their classification, causes and Engineering consideration; Faults their classification, causes and Engineering consideration.	5
Unit 4	**MINERALOGY AND PETROLOGY** Crystals, crystal structures and Optical properties of Minerals. Physical and Chemical properties of minerals. Origin and Type of Rocks; Origin and Types of Soils. Stress- Strain behaviors of Soil and Rocks. Index testing of Soil and Rocks.	10
Unit 5	**ENGINEERING GEOLOGY** Characteristics of good building stones, their uses, and distribution in India. Geological Considerations in Tunnels, Highway, Foundations, Dams, and Reservoirs. Plate Tectonics and Earthquakes, Earthquake Hazard assessment, Geological Hazards: Seismicity and Volcanism, Seismic zones in India and Aseismic constructions, Landslides, Land Subsidence and Mass moments. Groundwater preliminaries and groundwater flow, Groundwater related engineering issues and Groundwater overutilization.	11

List of Experiments:		**No. of Turns**
1	To determine the physical properties of minerals	**03**
2	Examination of typical rock-forming and ore minerals	**02**
3	Examination of rocks used for engineering purposes	**03**
4	Study of structural models	**02**
5	Simple dip and strike problems	**01**
6	Map work: finding out out-crop, drawing cross-section and understand the geological history	**02**
7	Map dealing with the location of dam and tunnel sites	**01**

Course Outcomes:	
1	Analyze the basic concepts of geological processes and their importance in civil engineering.
2	Develop skill of identification of rocks and minerals.

3	Describes the importance of geological structures in civil engineering projects.
4	To understand the geological risks connected to building different kinds of structures.

Textbooks:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication/ Reprint**
1.	"Engineering Geology," Parbin Singh, N.D. Kataria.	1996
2.	"Geological Structures and Maps: a Practical Guide 2020 Edition," Richard J. Lisle	2010
3.	"Structural Geology of Rocks and Region," George H. Davis, Stephen J. Reynolds, Charles F. Kluth	2011
4.	"The manual of Mineral Science," Cornelis Klein and Barbara Dutrow	2012
5.	"Geology of India and Burma," 6 th edition, Krishnan, M.S.	2012
6.	"Holmes' principles of physical geology," 3rd edition, Holmes, A.	2016
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication/ Reprint**
1	"Engineering Geology," Hries and Watson, John Viley.	1953
2.	"Geology of India" D.N.Wadia, Tata McGraw Hill, India.	1973
3.	"Geology for Engineers," D. S. Arora, Mahindra, Chd., Sons, New York	1984
4.	"Petrology", Tyrrell, B.L., N.D.	1994

Equivalent MOOC courses

Sr. No.	**Course Links**	**Offered by**
1.	Engineering geology https://nptel.ac.in/courses/105/105/105105106	NPTEL
2.	Engineering geology https://nptel.ac.in/courses/105/104/105104191	NPTEL
3.	Engineering geology https://nptel.ac.in/courses/105/104/105104147	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

Course Name	**:**	**Ground Water Hydraulics**	**DEC**
Course Code	**:**	**CEE110**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
The students shall be able to

- Understand the basic concept of ground water hydraulics.
- Analyse ground water flow with governing ground water flow equations.
- Apply analytical methods to identify sites for artificial recharge.
- Develop methodologies to resolve issues related to ground water.

Total No. of Lectures- 42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**GROUND WATER: INTRODUCTION AND ASSESSMENT** Groundwater vis-à-vis surface water, Role of groundwater in hydrological cycle, Hydrologic budget, Definition of groundwater Ground water resources status of India - Development and potential.	2
Unit 2	**OCCURRENCE OF GROUNDWATER** Vertical distribution of subsurface water, Saturated formation, Types of aquifers, Aquifer properties – porosity, void ratio, permeability, specific yield, specific retention, and storage coefficient, Measurement of water content and available water, Fence diagram.	3
Unit 3	**GROUND WATER MOVEMENT** Darcy's law and its validity, Hydraulic head and conductivity, Intrinsic permeability and transmissivity, Laboratory and field measurements of hydraulic conductivity, Homogeneous and isotropic systems, Groundwater flow rates, Groundwater flow directions - Flow nets, Governing equations of groundwater flow, Confined groundwater flow between two bodies, Steady unidirectional flow – confined and unconfined aquifers, Dupit's flow with and without recharge, Base flow to stream.	7
Unit 4	**WELL HYDRAULICS** Steady radial flow into a well – confined and unconfined aquifers, Unsteady radial flow into a well– confined and unconfined aquifers, Pumping and recuperation tests, Multiple well systems, Well losses, Specific capacity and safe yield, Hydraulics of open wells, Design of wells, Open wells versus borewells, Design problem of water well, Design of collector wells, Well construction.	12
Unit 5	**ARTIFICIAL RECHARGE OF GROUND WATER** Concept of artificial recharge, Recharge methods – merits, demerits and selection criteria, Artificial recharge strategy and identification of potential areas, Source water availability and assessment, Reuse and recycling wastewater, Rainwater harvesting, Innovative approaches for artificial recharge.	6
Unit 6	**SALINE WATER INTRUSION IN AQUIFERS** Occurrence of saline water intrusion, Ghyben–Herzberg relation between fresh and saline waters, Shape of the freshwater–saltwater interface, Effect of wells and tides on seawater intrusion, Upconing of saline water, Seawater intrusion in India, Control of saltwater intrusion.	6

7	**GROUNDWATER MANAGEMENT** Ground water basin management, Data collection for ground water management, Conjunctive use of surface and ground water, Management of coastal aquifers, Ground water management techniques.	6

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Understand the important flow characteristics and behaviours of aquifer.
2	Analyze the ground water flow problems and design of water wells.
3	Identify sites for artificial recharge of groundwater and determine the consequences of artificial recharge.
4	Recognize the issues related to ground water and their remedial solutions.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Groundwater hydrology", Todd, D. K., and Mays, L. W., John Wiley and Sons.	2004
2	"Hydraulics of groundwater", Bear, J. Courier Corporation.	2012
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Groundwater hydrology", Chahar, B. R., McGraw Hill.	2015
2	"Ground water", Raghunath, H. M., New Age International Publishers.	2007
3	"Engineering hydrology", Subramanya, K., McGraw Hill.	2014
4	"Groundwater hydrology: conceptual and computational models", Rushton, K. R., John Wiley and Sons.	2004

Equivalent MOOC courses

Sr. No	**Course link**	**Offered By**
1	https://nptel.ac.in/courses/105/103/105103026/- Web course on 'Ground Water Hydrology'.	**NPTEL**
2	https://nptel.ac.in/courses/105/105/105105042/-Video Course on 'Ground Water Hydrology'.	**NPTEL**
3	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-72-groundwater-hydrology-fall-2005/- Open Courseware Web Course on 'Ground Water Hydrology'	**MIT**

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

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DEPARTMENTAL ELECTIVE COURSES-II

Course Name	**:**	**Design of Steel Structures- II**	**DEC**
Course Code	**:**	**CEE111**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
At the end of this course, the student should be able to: • Design Steel plate girder and gantry girder. • Design trussed bridge. • Design various elements of industrial buildings. • Familiarize with plastic design and use of cold formed members.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**PLATE GIRDER** Components of plate girder, Economical depth, post buckling behaviour of web, design of plate girder including design of web, flanges, stiffeners, web splices, flange splices and connections.	8
Unit 2	**GANTRY GIRDER** Introduction, Loads, position of moving load for maximum effects, Profile of gantry girder section, Limitation of vertical deflections, Design of gantry girder.	5
Unit 3	**TRUSSED BRIDGE** Introduction to trussed girder bridges, various loads on the bridges, assumptions for design of trussed bridge, design of compression and tension members, calculation of wind load on trussed bridge, top and bottom lateral bracings, portal and sway bracings, bearings.	15
Unit 4	**INDUSTRIAL BUILDINGS** Design of components of Industrial building, different types of bracings, stepped columns and column bases.	6
Unit 5	**PLASTIC ANALYSIS AND DESIGN** Design of continuous beams and design concept of portal frame using plastic design approach.	5
Unit 6	**LIGHT GAUGE STEEL SECTIONS** Introduction and brief description of various type of cold formed light gauge steel sections, local buckling	3

Course Outcomes: At the end of this course, the student will be able to:	
1	Design plate girder and gantry girder.
2	Design various components of the trussed bridge.
3	Design various elements in industrial buildings.
4	Carry out plastic analysis of beams and familiarize with the usage of cold formed sections

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/**

		Reprint
1	"Design of Steel Structures", Arya & Awadhesh Kumar, Nem Chand and Bros., Roorkee.	2022
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Limit state design of Steel Structures", S.K. Duggal, Tata McGraw Hill.	2017
2	"Steel Structures: Design and practice", N. Subramanian, Oxford Publishing Press.	2010
3	"Design of Steel of Structures", S.S. Bhavikatti, I.K. International Publishing House Pvt. Ltd	2012
4	"Design of Steel Structures", Volume 2 Ramchandra S., Virendra Gehlot, Scientific Publishers, New Delhi,	2018
5	"Comprehensive Design of Steel Structures", Dr. B. C. Punmia, Ashok Kumar Jain. Laxmi Publications, New Delhi.	2015
6	Relevant IS codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/106/105106113/)---Design of Steel Structures II, IIT Madras	NPTEL
2	(https://archive.nptel.ac.in/courses/105/105/105105162/)---Design of steel structures, IIT Kharagpur	NPTEL

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

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Course Name	:	Road Safety	DEC/MSC
Course Code	:	CEE112/CEM203	
Credits	:	4	
L T P	:	3 1 0	

Course Objectives:

To make the students identify and design the various components of road safety planning, design, maintenance and executing safety policies.

- To understanding of road safety in planning and geometric design,
- To analyze the role of urban infrastructure design in safety
- To analyze the fundamentals of traffic engineering
- To analyze the accident data and risk management data, traffic management systems for road safety

Total No. of Lectures – 42

Lecture-wise break-up		No. of Lectures
Unit 1	**Unit I:** Road Safety in Planning and Geometric Design: Vehicle and Human Characteristics, Road Design and Road Equipment's, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care	8
Unit 2	**Unit II:** Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their Safety.	10
Unit 3	**Unit III:** Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.	8
Unit 4	**Unit IV:** Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction	8
Unit 5	**Unit V:** Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.	8

Course Outcomes:

At the end of the course the students will be able to:

1	Identify the components of road safety.
2	Plan, design and execute of road safety.
3	Choose the suitable statistical analysis for road safety

4	Realize the importance of road safety data studies and traffic management

Textbooks:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Traffic Engineering and Transportation Planning" L.R. Kadiyali, Khanna Publishers	2013
2.	Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall	2002
Reference Book:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Handbook of Road Safety measures", Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson, second Edition, emrald	2004
2.	"Fundamentals of Traffic Engineering", Richardo G Sigua	2008
3.	"Road Safety", NCHRP	Latest

Equivalent MOOC courses

Sr. No	**Course link**	**Offered By**
1	https://nptel.ac.in/courses/105101008/582_Accident/point20/point.html Road Safety Audit	**NPTEL**
2	https://nptel.ac.in/courses/105105215 Traffic Engineering	**NPTEL**

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

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Course Name	**:**	**Hydro Power Engineering**	**DEC**
Course Code	**:**	**CEE113**	
Credits	**:**	**4**	
L – T – P	**:**	**3 – 1 – 0**	

Course Objectives (COs):
The students should be able-

- To understand the different forms of energy, types of power plants, and hydropower development in India.
- To analyze the detailed knowledge of hydropower components like Intake structures, Trash racks, Penstocks, etc.
- To apply the knowledge of hydropower engineering in solving daily life problems.
- To understand and analyze the concepts of Water Hammer and surge in Hydropower development.

Total No. of Lectures – 42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Sources of power, Role of hydropower in power system, Necessity and importance of harnessing small hydropower, Hydro power potential in India.	3
Unit 2	**ESTIMATION OF WATERPOWER POTENTIAL** Flow duration and power duration curves, Load curve, Load factor, Capacity factor, Utilization factor, Diversity factor, Firm and secondary power, and Prediction of load.	6
Unit 3	**TYPES OF HYDROPOWER PLANTS** Elements of Hydropower, Classification of hydropower plants, Run-of-river plants, General arrangement of run-of-river plants, Valley dam plants, Diversion canal plants, High head diversion plants, Storage and pond age, Pumped storage power plants, Base load andpeak load plants in a power grid.	6
Unit 4	**PENSTOCKS** General classification, Design criteria, Economic diameter, Losses, Valves, Bends and Manifolds.	5
Unit 5	**TRASH RACKS** Types, Losses, Design, Stability.	4
Unit 6	**INTAKES** Types, Losses, Air entrainment, Anti-vortex device, Air vent, Power channels, Fore bay, Tunnel.	4
Unit 7	**TURBINES** Introduction, Types of turbines, Hydraulics of turbines, Velocity triangles, Draft tubes, Cavitation in turbines, Characteristics of turbines.	7
Unit 8	**WATER HAMMER AND SURGES** Introduction, Water hammer, Transients caused by turbine, Load acceptance, and rejection, Resonance in penstocks, Surge tanks, Channel surges.	7

Course Outcomes (COs): At the end of the course, the students will be able to:	
1	Solve the hydropower-related problems arising in Water Resources projects.
2	Estimate the waterpower potential in perennial rivers and should be able to design important hydraulic components of hydropower.
3	Estimate the hydropower potential of a catchment area
4	Analyze and solve the water hammer and surge phenomenon in hydropower generation.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Water Power Engineering", Dandekar, M. M., and Sharma, K. N., Vikas Publishing House.	2016
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"A Textbook of Water Power Engineering", Sharma, R. K., and Sharma, T. K., S. Chand Publishing.	2003
2	"Irrigation and Water Power Engineering", Punmia, B. C., Lal, P. B. B., Jain, A. K., and Jain, A. K., Laxmi Publications, Ltd.	2009
3	"Hydro Power Structures", Varshney, R.S., Nem Chand and Bros.	2001
4	"Applied Hydraulic Transients", Chaudhry, M. H., Van Nostrand Reinhold Company.	2022

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

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Course Name	:	Unit Processes in Water and Wastewater Treatment	DEC
Course Code	:	CEE114	
Credits	:	4	
L T P	:	3 1 0	

Course Objectives:

The student should be able to

- To understand the principles of various physio-chemical and biologicalprocesses
- Design the components for water supply
- Design the components wastewater treatment plants.
- Develop a knowledge of sludge handling

Total No. of Lectures – 42

Lecture-wise break-up		No. of Lectures
Unit 1	**WATER TREATMENT** Technologies for the removal of suspended, colloidal and dissolved solids and for disinfection, Design of aeration, Coagulation- flocculation-settling, Filtration, Membrane processes, Ion exchange, Adsorption, Chlorination, etc., Selection of suitable water treatment technology for given water.	14
Unit 2	**WASTEWATER CHARACTERIZATION** Quantification of sewage, Types of sewerage systems, Characterization of sewage, Treated sewage quality standards.	4
Unit 3	**WASTEWATER TREATMENT** Principles and Design of Preliminary treatment, Primary treatment, Secondary treatment technologies, Attached and suspended growth biological processes, Tertiary treatment, Decision making for suitable wastewater treatment technology, Concept of a common effluent treatment plant.	17
Unit 4	**DISPOSAL OF TREATED EFFLUENT** Disposal on land, Quality standards for irrigation water, Disposal inwater bodies, Self-purification of river, Streeter-Phelps equation.	4
Unit 5	**SLUDGE HANDLING** Sludge Thickening, Sludge Stabilization (Aerobic and Anaerobic), Dewatering, Sludge Drying beds, Disposal of dried sludge.	3

Course Outcomes (COs):

At the end of the course the students will be able to:

1	Characterize ground and surface water quality.
2	Identify best practicable environmental option (BPEO) and design a watertreatment plant.
3	Characterize wastewater and identify BPEO for wastewater treatment.
4	Identify BPEO for disposal of effluent and sludge.
5	Design a wastewater treatment plant.

Text Books:		
S.no.	**Name of Books/Author/Publisher**	**Year of Publication s/Reprint**
1	"Environmental Engineering", Howard S. Peavy, D.R. Rowe, G. Tchobanglous, McGrawHill Book Co., New Delhi	2017
2	"Environmental Engineering (Volume 1 & 2) Water Supply Engineering", Santosh Kumar Garg Khanna Publishers, New Delhi	2010
Reference Books :		
S.no.	**Name of Books/Author/Publisher**	**Year of Publication s/Reprint**
1	"Manual on sewerage and sewage treatment" Ministry of Urban Development,New Delhi.	2013
2	"Manual on Water Supply Engineering", Expert Committee Ministry of urbanDevelopment, New Delhi	1999
3	"Environmental Engineering Volume 1 & 2" Standard Book House, New Delhi	2004
4	IS: 10500 – 2012. Drinking Water Specifications. Bureau of Indian Standards, NewDelhi.	2012

Equivalent MOOCs Courses

Sr. No.		**Offered by**
1	https://nptel.ac.in/courses/105/107/105107207/ - NPTEL video course on 'Water andWastewater treatment'.	NPTEL
2	https://www.classcentral.com/course/swayam-wastewater-treatment-and-recycling- 14353 or https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ce32/Web course on'Wastewater treatment and recycling'.	NPTEL
3	https://sswm.info/sites/default/files/reference_attachments/UN%20HABITAT%202008%20Constructed%20Wetlands%20Manual.pdf Constructed Wetland Manual	NPTEL
4	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ce23/ - NPTEL video course on'Water Supply Engineering'	NPTEL

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO8**	**PO9**	**PO1 0**	**PO 11**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	3	2	-	3	2	-	2	1	1	-	2	3	2	2	1	2
CO2	3	3	2	1	2	-	1	2	1	1	-	3	3	1	1	2
CO3	3	2	3	2	2	1	1	1	-	-	2	2	3	1	2	1
CO4	3	3	2	2	3	2	3	1	2	1	2	1	3	2	1	1

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Course Name	**:**	**Disaster Management**	**DEC**
Course Code	**:**	**CEE115**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
• To analyze the causes and effects of various natural and man-made disasters. • To explore hazard and risk assessment. • To enable to plan various mitigation measures and capacity building. • To develop infrastructure for disaster management. • To apply applications of Remote Sensing in disaster mitigation.

Total No. of Lectures- 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO DISASTER MANAGEMENT** Natural Disasters, Man-made hazards, causes, consequences, earthquakes, Floods, Drought, Coastal Hazards, Landslides, rockslides and Forest Fires, Tsunamis, Oil spillage, Gas leakage, etc.	5
Unit 2	**DISASTER MITIGATION AND PREPAREDNESS** Mitigation measures for natural disasters- Earthquakes, Tsunamis, Cyclones, Floods, Landslides, etc.; Mitigation measures for various industrial hazards/disasters; Preparedness for natural disasters.	7
Unit 3	**HAZARD AND RISK ASSESSMENT** Assessment of capacity, vulnerability and risk; vulnerability and risk mapping; stages in disaster recovery and associated problems.	5
Unit 4	**EMERGENCY MANAGEMENT SYSTEMS** Emergency medical and essential public health services, response and recovery operations; Reconstruction and rehabilitation.	5
Unit 5	**CAPACITY BUILDING** Disaster management approach to inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, an overview of disaster management in India.	8
Unit 6	**INTEGRATION OF PUBLIC POLICY** Planning and design of infrastructure for disaster management; Community based approach in disaster management; Methods for effective dissemination of information; Ecological and Sustainable development models for disaster management.	6
Unit 7	**ROLE OF REMOTE SENSING IN DISASTER MITIGATION** Importance of Remote Sensing in disaster mitigation, Case studies	6

Course Outcomes:	
1	To annotate the causes and effects of various disasters.
2	To plan risk management/disaster mitigation techniques.
3	To evaluate the mitigation measures (Case study).
4	To demonstrate role of Remote Sensing in Disaster mitigation.

Textbooks:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication / Reprint**
1.	"Elements of Earthquake Engineering," Jai Krishna, Chandrasekharan and B. Chandra, South Asian Publishers, New Delhi.	2000
2.	"Disaster Management," R.B. Singh (Ed), Rawat Publications.	2006
3.	"Disaster Management –Future Challenges & Opportunities," Jagbir Singh, I.K. International Publishing House.	2007
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication / Reprint**
1.	"Natural Hazards in the Urban Habitat," Iyengar, C.B.R.I., Tata McGraw Hill. Publications.	1997
2.	"Natural Disaster Management," Jon Ingleton (Ed), Tudor Rose, Leicester.	1999
3.	"Earthquake Resistant Design of Structures," Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.	2006

Equivalent MOOCs courses:		
Sr. No.	**Course Links**	**Offered by**
1.	Natural Hazards https://onlinecourses.nptel.ac.in/noc20_ce07/preview	NPTEL
2.	Disaster Management https://archive.nptel.ac.in/courses/105/104/105104183/	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

DEPARTMENTAL ELECTIVE COURSES-III

Course Name	**:**	**Seismic Design of Structures**	**DEC**
Course Code	**:**	**CEE101**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
At the end of this course, the student should be able to: • Understand the basic concepts of structural dynamics. • To analysis and design RC structures for seismic forces as per IS Codal guidelines. • Perform ductile detailing of RC and Masonry Buildings.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Introduction to seismology. Basic terminology used.	4
Unit 2	**THEORY OF VIBRATIONS** Analysis of SDOF for undamped free vibration, damped free vibration, Forced vibration, transient vibration, Introduction to response spectrum.	10
Unit 3	**DUCTILITY PROVISIONS IN EARTHQUAKE RESISTANT DESIGN OF RC BUILDINGS** Introduction, Importance of Ductility, Requirements for Ductility, Factors affecting Ductility, Ductile detailing considerations as per IS code.	10
Unit 4	**SEISMIC ANALYSIS OF RC BUILDINGS** IS Codal requirements for seismic resistant design, calculation of seismic load, load combinations, permissible stresses as per IS codal provisions using equivalent static method and dynamic analysis method. Lateral distribution of base shear, design of flexural and compression member. Introduction to design of shear wall.	10
Unit 5	**DUCTILITY PROVISONS FOR MASONRY BUILDINGS** Categories of masonry buildings, seismic behaviour of unreinforced and reinforced masonry walls, Box action and bands, behaviour of infill walls, improving seismic resistance of masonry buildings as per IS Codal Provisions.	8

Course Outcomes: At the end of this course, the student will be able to:	
1	Understand the basic concepts of dynamic analysis of structures.
2	Design and detail earthquake resistant RC structural elements.
3	Incorporate ductile detailing for masonry building.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**

1	"Dynamics of Structures," A.K. Chopra, Pearson Education.	2012
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Structural Dynamics (Theory & Computation)," Mario Paz.	2014
2	"Masonry and Timber Structures including Earthquake Resistant Design," A.S. Arya, Nem Chand & Bros.	2009
3	"Earthquake Resistant Design of Masonry Buildings," Miha Tomazevic, Imperial College Press.	2011
4	"Earthquake Resistant Design of Structures," S.K. Duggal, Oxford.	2017
	Relevant IS codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	(https://onlinecourses.nptel.ac.in)- NPTEL web course on 'Seismic Analysis of structures'. •	NPTEL
2	(https://onlinecourses.nptel.ac.in)- NPTEL web course on 'Structural Dynamics	NPTEL

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

1 – Slight (Low) Correlation
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Course Name	**:**	**Traffic Engineering**	**DEC**
Course Code	**:**	**CEE116**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:

- To make the students learn human and vehicular characteristics affecting transportation system, , brief knowledge of road signs, road markings and traffic signalling system, and basic principles of traffic regulation and management.
- To carryout various types of traffic studies, collection of data, and report them in required formats.
- To understand the various statistical concepts and utilize them for application in traffic engineering.
- To introduce the brief knowledge of road signs, road markings and traffic signaling system, and basic principles of traffic regulation and management
- To know the different computer applications for traffic simulation

Total No. of Lectures – 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**TRAFFIC ENGINEERING FUNCTIONS AND TRAFFIC CHARACTERISTICS** Functions of traffic engineering, Organization of trafficEngineering Department, Importance of Traffic engineering under Indian conditions. Road user Characteristics, "PIEV" theory, Vehicular characteristics, IRC Specifications on vehicular dimensions and weights.	4
Unit 2	**TRAFFIC STUDIES** Urban Road Classification, Traffic Volume Studies, Speed Studies, Origin- Destination Studies, Traffic Capacity and Level of service, Parking Studies, Accident Studies	9
Unit 3	**STATISTICAL METHODS FOR TRAFFIC ENGINEERING** Collection and presentation of Statistical Traffic Data, Mean, Standard Deviation and Variance, Poisson and Binomial Distribution, Normal Distribution, Sampling Theory and significance testing, Linear Regression and Correlation.	7
Unit 4	**TRAFFIC ENGINEERING DESIGN** Principle of road junction design, Design of intersections, Rotary intersections, Design of parking facilities.	5
Unit 5	**TRAFFIC CONTROL DEVICES** Need for international standardization, Traffic signs, Road markings and design of Traffic signals.	7
Unit 6	**TRAFFIC REGULATIONS AND MANAGEMENT** Basic principles of Regulation, Regulation of speed, Regulation of vehicles, Regulation concerning driver, Parking Regulations and Enforcement of Regulations, Traffic management measures	3

Unit 7	**FUNDAMENTAL PRINCIPLES OF TRAFFIC FLOW** Traffic flow elements, Flow density relationships, Mathematical relationships describing Traffic flow (Macroscopic and Microscopic models)	5
Unit 8	**INTRODUCTION TO TRAFFIC SIMULATION SOFTWARES**	2

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Carryout different traffic surveys to collect the data, analyze and report in prescribed format.
2	Plan an urban highway utilizing concepts of traffic studies.
3	Design various geometric elements of a rotary, bus terminal, parking, traffic signals etc.
4	Apply the learned concepts and statistical methods in real life traffic engineering problems.

Textbooks:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	‘‘Principles of Transportation Engineering”, Khitoliya R.K. and Gupta P.K, Dhanpat Rai Publishing, New Delhi.	2017
2.	“Text Book of Highway & Traffic Engineering”, Saxena S.C., CBS Publisher.	2020
Reference Book:		
1.	“Traffic Engineering”, Roger P. Roess, Elena S. Prassas, PearsonEducation.	2019
2.	“Traffic & Highway Engineering with MindTap**”,** Nicholas J. Garber.	2015

Sr. No	**Code Name**	**Year**
1	IRC:3-1983 Dimensions & Weights of Road Design Vehicles (First Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.003.1983.pdf	1983
2	IRC:54-1974 Lateral and Vertical Clearances at Underpasses for Vehicular Traffic https://law.resource.org/pub/in/bis/irc/irc.gov.in.054.1974.pdf	1974
3	IRC:64-1990, Guidelines for Capacity of Roads in Rural Areas (First Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.064.1990.pdf	1990
4	IRC:65-2017 RecommendedPractice for Traffic Rotaries https://law.resource.org/pub/in/bis/irc/irc.gov.in.065.2017.pdf	2017
5	IRC:70-2017, Guidelines on Regulation and Control of Mixed Traffic in Urban Areas https://law.resource.org/pub/in/bis/irc/irc.gov.in.070.2017.pdf	2017
6	IRC:93-1985 Guidelines on Design and Installation of Road Traffic	1985

	Signals https://law.resource.org/pub/in/bis/irc/irc.gov.in.093.1985.pdf	
7	IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas https://law.resource.org/pub/in/bis/irc/irc.gov.in.106.1990.pdf	1990
8	IRC:SP:12-2015 Guidelines for Parking Facilities in Urban Roads" (First Revision) https://law.resource.org/pub/in/bis/irc/irc.gov.in.sp.012.2015.pdf	2015

Equivalent MOOCs courses

Sr. No	Course link	Offered By
1	https://nptel.ac.in/courses/105105107 "Transportation Engineering"	**NPTEL**
2	https://nptel.ac.in/courses/105101087 "Transportation Engineering 1"	**NPTEL**
3	https://archive.nptel.ac.in/courses/105/105/105105215/ "Transportation Engineering"	

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

1 - Slight(low) Correlation
2 - Moderate(Medium) Correlation
3 - Substantial(High) Correlation
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Course Name	:	Stochastic Hydrology	DEC
Course Code	:	CEE117	
Credits	:	4	
L T P	:	3 1 0	

Course Objectives:
The students shall be able to:

- Understand the concepts of probability theory and stochastic processes.
- Analyse the distributional characteristics of hydrologic data.
- Apply statistical methods for analyzing hydrologic data
- Apply stochastic methodologies in forecast of hydrologic event.

Total No. of Lectures – 42

Lecture-wise breakup		No. of Lectures
Unit 1	**BASIC CONCEPTS OF PROBABILITY AND STATISTICS** Random variables, random experiments, Axioms of probability, Conditional, marginal, and joint probability, Total probability theorem and Bayes' rule, Discrete and continuous random variables.	3
Unit 2	**BASIC STATISTICAL PROPERTIES OF DATA** Descriptive statistics – measures of central tendency, dispersion, symmetry and tailedness, Concept of moments and expectation, Covariance and correlation, Parameter estimation – method of moments and maximum likelihood, Chebyshev inequality, Graphical representation of hydrologic data.	5
Unit 3	**PROBABILITY DISTRIBUTION OF HYDROLOGIC VARIABLES** Discrete probability distributions – Binomial, Geometric, and Poisson distributions, Continuous probability distributions – Uniform, Exponential, Normal, Lognormal, Gamma, and Extreme Value distributions, Flood frequency analysis.	6
Unit 4	**HYPOTHESIS TESTING** Hypothesis testing, Parametric and non-parametric estimation, Goodness-of-fit tests – Anderson-Darling test, Kolmogorov-Smirnov test, Chi-square test, Parametric tests and Non-parametric tests.	7
Unit 5	**REGRESSION ANALYSIS** Simple linear regression, Multiple linear regressions, Evaluation of regression model, Correlation and regression, Correlation and causality, Confidence interval.	5
Unit 6	**TIME SERIES ANALYSIS** Components of a time series, stationary and non-stationary time series, Homogeneity in a time series and its assessment, Trend analysis, Data generation techniques.	6
Unit 7	**TIME SERIES MODELLING** Properties of time series models, Auto-regressive (AR) models, Moving average (MA) models, Auto-regressive moving average (ARMA) model, Auto-regressive integrated moving average (ARIMA) model, Parsimony of time series models, Diagnostic check of models.	8

Unit 8	**CASE STUDIES** Case studies related to time series analysis and modelling for hydrologic applications.	2

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Familiarize with the concepts of probability and statistical properties of hydrologic data.
2	Identify the distributional characteristics of hydrologic data and their applications.
3	Perform statistical hypothesis test for time series analysis and develop relationship between hydrologic variables.
4	Study the time series characteristics and development of statistical models for forecasting hydrologic time series.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Statistical Methods in Hydrology:, Hann, C.T., First East-West Press Edition, New Delhi.	2005
2	"Applied Hydrology", Chow, V. T., Maidment, D. W., and Mays, L. W., Tata Mc-Graw Hill Education.	2010
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Statistical Models in Hydrology", Clarke, R.T., John Wiley, Chinchester.	2004
2	"Stochastic Hydrology", Reddy, P. J. R., Laxmi Publications.	2007.
3	"Statistical Methods in Hydrology and Hydroclimatology (Vol. 585)", Maity, R., Springer.	2018
4	"Stochastic Water Resources Technology, Kottegoda, N. T., The Macmillan Press, New York.	2002

Equivalent MOOCs courses

Sr. No	**Course link**	**Offered By**
1	https://nptel.ac.in/courses/105/108/105108079/- 'Stochastic Hydrology'.	**NPTEL**

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

1 - Slight(low) Correlation
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Course Name	**:**	**Environmental Pollution Management**	**DEC**
Course Code	**:**	**CEE118**	
Credit	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives
The student should be able to • Imbibe the basic knowledge of the subject • Impart up-to date know of air, water pollution • Understand the basic principles of environmental pollution • Design various pollution control strategies

Total No. of Lectures – 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**WATER POLLUTION** Water pollution sources, Water quality parameters, Types of water pollutants, Water quality modelling design of water and treatment facilities and, Ground Water Pollution and Remediation.	10
Unit 2	**AIR POLLUTION** Air quality index (AQI), Air pollution standards Influence of meteorological phenomena on air quality, Modelling and design Engineered systems for air pollution control.	15
Unit 3	**NOISE POLLUTION AND CONTROL** Definition, **Psychological** & Pathological effects of noise, Physical nature of noise. Sound, amplitude frequency, intensity loudness, noise pollution standards noise pollution control, Noise barriers, models	8
Unit 4	**SOLID WASTE MANAGEMENT** Generation, Collection, Processing and Disposal, and landfill design.	9

Course Outcomes (COs): **At the end of the course students will be able to:**	
1	Identify and evaluate the environmental pollution problems.
2	Design and suggest strategies for pollution control and management
3	Decide air and noise pollution control measures.
4	Propose method for Solid waste management.

Text Books		
S.no.	**Name of Books/Author/Publisher**	**Year of Publications/**
1	"Introduction to Environmental Engineering and Science", Masters, G.M. and Ela WP, Pearson Education, Singapore	2021
2	"Environmental Engineering", Peavy. H.S., Rowe, D.R. Tchobanoglous G, McGraw Hill, NY	2021

Reference Books		
1	"Air Pollution", Rao, M. N. & Rao, H. V. N., Mc Graw Hill Ed.	2020
2	"Environmental Pollution Control Engineering", Rao, C.S., New Age International Publishers	2021
3	"Environmental Engineering", Gerard Kiely, Tata Mcgraw Hill.	2007

Equivalent MOOCs Courses

Sr.No.	Course Links	Offered by
1	https://nptel.ac.in/courses/105/104/105104099/-NPTEL video course on Environmental Air Pollution	- NPTEL
2	https://nptel.acin/courses/105/105/105105178/ Treatment and Recycling - NPTEL video course on Wastewater	- NPTEL
3	https://www.edx.org/learn/environmental-science/world-bank-group-solid-waste-management	- NPTEL

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

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Course Name	**:**	**Remote Sensing and GIS**	**DEC**
Course Code	**:**	**CEE102**	
Credits	**:**	**4**	
L – T – P	**:**	**3 – 0 – 2**	

Course Objectives:
• To make the students understand the concept of digital mapping • To appraise the students with the recent advancements/software in surveying like Remote sensing, GIS, etc.

Total No. of Lectures – 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**CONVENTIONAL MAPPING** Conventional Mapping, Overview of conventional data collection techniques, Limitations, Need of interventions of technology	2
Unit 2	**EVALUATION OF DIGITAL MAPPING AND PROCURING OF DATA** Introduction to digital mapping, advantages, applications, data collection techniques, Present Status in India and abroad, Methodology of procuring of GIS/Remote Sensing data	5
Unit 3	**AERIAL PHOTOGRAMMETRY AND DRONE MAPPING** Types, Stereoscopy, Scale of a photograph, flight planning, Introduction to Drones applications, working and limitations	5
Unit 4	**GEOGRAPHICAL INFORMATION SYSTEM (GIS)** Introduction, advantages, objectives of GIS, Definitions of GIS, Components of GIS, Overlay analysis, DTM, DEM, Spatial, Non-Spatial, Raster, Vector	6
Unit 5	**INTRODUCTION TO REMOTE SENSING (RS)** Introduction, EMS, Ideal & Real RS System, Visual Image interpretation, active and passive remote sensing, Reflectance; SRC, Energy interaction in the atmosphere; energy interactions with the Earth's surface, Resolution	7
Unit 6	**THERMAL AND MICROWAVE REMOTE SENSING** Basics, Introduction, importance, need of thermal and microwave remote sensing	5
Unit 7	**DIGITAL IMAGE PROCESSING (DIP)** Introduction, Histogram, Rectification, Registration, Orientation, Radiometric errors, and Geometric errors. Image Enhancement Techniques, Image classification – Supervised and Unsupervised classification, Digital Image data Formats: BSQ, BIL, BIP, Change Detection	8
Unit 8	**APPLICATIONS OF REMOTE SENSING IN ENGINEERING** Applications of Remote Sensing, Case studies	4

Break-up of the Practical:		**No. of Turns**
1	Introduction to the basics of GIS and RS software	02
2	Digitization of features (linear, point, polygon) and editing	04
3	Addition of attributes, query generation	04

4	Methods of procuring and working of Remote Sensing Images	04

Course Outcomes (COs): At the end of the course, the students will be able to:	
1	Understand the evaluation of advanced surveying techniques
2	Understand the working of Remote Sensing and ancillary products
3	Understand the workings of GIS
4	Prepare digital maps using software

Textbooks:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Geomatics Engineering," Manoj Arora and R C Barjatiya, Nem Chand Brothers, Roorkee.	2003
2	"Principles of GIS," Peter A. Burrough, Rachael A., Oxford University Press.	2001
3	"Application of Geomatics in Civil Engineers", Ghosh and D.A. Silva, Springer.	2020

Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	"Remote Sensing and Image Interpretation," Lillesand and Kiefer, Wiley Publishers.	1999

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1	https://nptel.ac.in/courses/105/108/105108077/ NPTEL video course on Remote Sensing	NPTEL
2	https://nptel.ac.in/courses/105/107/105107160/ NPTEL video course on Digital Image Processing of Remote Sensing data	NPTEL
3	https://nptel.ac.in/courses/105/103/105103193/ NPTEL video course on Remote Sensing and GIS	NPTEL
4	https://nptel.ac.in/courses/105/107/105107201/ NPTEL video course on Remote Sensing Essentials	NPTEL
5	https://nptel.ac.in/courses/105/101/105101206/ NPTEL video course on Remote Sensing Principles and Applications	NPTEL

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

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Course Name	**:**	**Green Buildings Materials & Techniques**	**DEC**
Course Code	**:**	**CEE119**	
Credits	**:**	**4**	
L – T – P	**:**	**3-1-0**	

Course Objectives:
The student should be able to • understand basics of green design and sustainable development concept. • understand guidelines for development and certification of green designs. • identify different types of green building materials. • understand the principles of effective energy and resource management in buildings.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO GREEN BUILDINGS** Definition of green buildings, definition of sustainability, typical featuresof green buildings, benefits of green buildings towards sustainable development, Case Studies.	3
Unit 2	**GREEN BUILDINGS RATING SYSTEM & CODES** Energy codes (ECBC) requirement, Certification & Rating system for green buildings, green rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), Indian Green Building Council (IGBC).	5
Unit 3	**GREEN BUILDINGS MATERIALS** Green building materials, Natural and renewable materials, Recycled materials, Environmental impact of building material, Material Efficiency, Embodied Energy in Building Materials, Operational energy in Building and life cycle analysis, methods to reduce embodied energy in building materials.	8
Unit 4	**SITE SELECTION & PLANNING** Criteria for site selection, planning for thermal comfort, day lighting, ventilation.	4
Unit 5	**WATER CONSERVATION AND EFFICIENCY** Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.	5
Unit 6	**ENERGY CONSERVATION & EFFICIENCY** Heating & Cooling Systems, Passive solar heating & cooling, Techniques for Maximizing energy performance, Use of BIPV and other renewable energy sources in buildings, power generation, Energy efficient building envelopes, Solar Heat Gain Coefficient, U-Values for facade materials, zero ozone depleting potential (ODP) materials, energy metering and monitoring, efficient lighting technologies, net zero energy buildings.	7
Unit 7	**WASTE MANAGEMENT** Solid waste management and techniques, Handling of construction & demolition waste materials.	5
Unit 8	**INDOOR ENVIRONMENT QUALITY** VOC emission issues & indoor air quality for sustainability, health hazards, measuring indoor air quality, ventilation system for improved air quality, Methods of improving indoor air quality.	5

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Apply principles and practices of green buildings and its standards.
2	Identify appropriate green building material and technique.
3	use natural resources and energy for sustainable development.
4	Design sustainable and energy efficient buildings.

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Sustainable Construction: Green Building Design and Delivery," Charles J. Kibert, John Wiley & Sons	2012
2.	"Green Building Fundamentals," Mike Montoya, Pearson, USA	2010
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Hand book of Green building Design and construction," Sam Kubba, Elsevier Architecture Press.	2010
2.	"Green building: principals and practice in residential construction," Abe Kruger and Carl Seville, Cengage Learning.	2012
3.	"Alternative building materials and technologies", K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, New age international publishers	2007
4.	"Sustainable Construction and Design", Regina Leffers, Pearson/ Prentice Hall, USA	2009
5.	IGBC Green New building rating system (Version 3.0)	2015
6.	Energy Conservation Building Code. Bureau of Energy Efficiency.	2018
7.	Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi	2004

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	(https://archive.nptel.ac.in/courses/105/102/105102195/)- Sustainable Materials & Green Buildings, IIT Delhi	NPTEL
2.	(https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ar03/)- Sustainable Architecture, IIT Roorkee	NPTEL

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

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DEPARTMENTAL ELECTIVE COURSES-IV

Course Name	**:**	**Bridge Engineering**	**DEC**
Course Code	**:**	**CEE120**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
The student should be able to • develop an understanding of terminologies related to bridge engineering. • analyse and design superstructure of various types of bridges. • analyse and design substructure of bridges. • Understand different construction techniques for bridges.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Types of bridges, Investigation for bridges, Selection of suitable type of bridge, Design loads for highway and railway bridges as per IRC and IRS standards respectively.	8
Unit 2	**RCC CULVERTS** Design of RCC slab culvert.	4
Unit 3	**RCC T-BEAM and SLAB BRIDGE** Design of RCC T-Beam and slab bridge.	6
Unit 4	**PRE-STRESSED CONCRETE BRIDGES** Types of pre-stressed concrete bridges, losses in prestressing, Design considerations for pre-stressed concrete bridges.	4
Unit 5	**STEEL PLATE GIRDER BRIDGE** Design of steel plate girder railway bridge.	8
Unit 6	**BRIDGE SUBSTRUCTURE** Design considerations for bridge piers, abutment, and bridge foundations. Various types of bearings, Design of elastomeric bearings.	8
Unit 7	**CONSTRUCTION METHODS** Introduction to construction/erection methods for bridges.	4

Course Outcomes: By the end of this course, the student will be able to:	
1	Carry out preliminary investigation for bridges.
2	Design superstructure of bridges.
3	Design substructure of bridges.
4	Classify different construction techniques.

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Essentials of Bridge Engineering", D. Johnson Victor, Oxford – IBH Publ. New Delhi.	2019
2.	"Design of Bridges", N. Krishna Raju, Oxford-IBN Publisher.	2019

Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Design of Concrete Bridges", M. G Aswani, V. N Vazirani, M. M Ratwani, Khanna Publishers.	2004
2.	"Bridge Deck Analysis", R.P.Pama & A.R.Cusens, John Wiley & Sons.	
3.	"Design of Steel Structures", Arya & Awadhesh Kumar, Nem Chand and Bros., Roorkee.	2022
4.	"Design of Bridge Structures", T.R.Jayaram & M.A.Jagadeesh, Prentice Hall of India, New.Delhi.	2009
5.	Relevant IS and IRC codes (Latest Revision)	

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	(https://nptel.ac.in/courses/105105177/)- Reinforced Concrete Road Bridges, IIT Kharagpur	NPTEL
2.	(https://archive.nptel.ac.in/courses/105/105/105105216)- Bridge Engineering, IIT Dhanbad	NPTEL

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

1 – Slight (Low) Correlation
2 – Moderate (Medium) Correlation
3 – Substantial (High) Correlation
"-" indicates there is no correlation.

Course Name	**:**	**Transportation Planning and Management**	**DEC**
Course Code	**:**	**CEE103**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:

- To make the students learn about basics of transportation planning process.
- To determine the travel demand using different techniques of trip generation, distribution, mode choice and network assignment and various land-use patterns
- To make the student to learn about basic concepts of traffic management techniques and fundamentals of transport management system.
- To introduce the student to transport policy and transportation-environment.

Total No. of Lectures – 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**GENERAL CONCEPT AND PROCESS** General Concept and Process, Hierarchical Levels of Planning, Passengers and Goods Transportation.	4
Unit 2	**URBAN TRAVEL CHARACTERISTICS** Urban Travel Characteristics, Private & Public Travel Behaviour analysis, Introduction to urban freight transportation.	4
Unit 3	**TRAVEL DEMAND** Travel demand Estimation, Forecasting methods and Models, Trip Generation methods, Model Split analysis, Trip Distribution- Growth factor method, Gravity models, Intervening opportunity	14
Unit 4	**NETWORK CAPACITY AND DISTRIBUTION** Network assignments, Capacity Restrained and simultaneous distribution, Direct demand models	5
Unit 5	**TRANSPORT PLANNING** Land-use Transport Planning, State-wide and Regional Transportation Planning	2
Unit 6	**TRANSPORT POLICY** Transport and energy, transport and environment, Transport management (policy, organization, legal provisions), integration and coordination	3
Unit 7	**TRANSPORT MANAGEMENT** Fundamentals of Traffic Management, Principles and Methodology, Traffic Systems Management, Technique of management, Exclusive Bus Lanes Traffic Management Techniques, Speed control and Zoning, Parking Control, Traffic Segregation and Channelization, Principles and Design of Traffic Signs, Their Placement and Visibility. Transportation System Management, Route and Network Management, Area Traffic Management, City wide Traffic Control and Management, Centralized Data Processing and Monitoring.	10

Course Outcomes: By the end of this course, the student will be able to:	
1	Apply the learned concepts of traffic planning.
2	Estimating travel demand based on different forecasting methods, trip generation, distribution, modal split and network assignment.
3	Ability to apply traffic management techniques.
4	To understand the transport-environment and transport policy.

Suggested Textbooks:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Transport Engineering and Planning", Papacostas C.S.,Pearson Education India.	2015

Reference Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1.	"Transport Planning & Traffic Engineering", O'Flaherty Coleman A., CRC Press.	2018
2.	"Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer", Tiwari G. and Mohan D., CRC Press.	2016

Equivalent MOOC courses

Sr. No	**Course link**	**Offered By**
1	https://nptel.ac.in/courses/105/107/105107067/ 'Urban transportation planning'.	NPTEL
2	https://nptel.ac.in/courses/video/105106058/ 'Introduction to transportation planning'	NPTEL

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

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Course Name	**:**	**Water Resources Planning and Management**	**DEC**
Course Code	**:**	**CEE121**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
The students shall be able to:

- Understand the aspects related to planning and management of water resources.
- Analyse the water resources project with system approach.
- Apply the applications of system engineering.
- Develop methodologies for Water Resources Planning and Management.

Total No. of Lectures – 42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**WATER RESOURCES PLANNING** Role of water in national development, Assessment of water resources, Planning process, Long-term planning, Functional requirements in multipurpose planning.	4
Unit 2	**ELEMENTS OF WATER RESOURCES DEVELOPMENT** Reservoir planning - dependable yield, Sequent peak algorithm, Sedimentation in reservoir, Reservoir capacity, Empirical-area reduction method, Reservoir operation – standard operating policy.	8
Unit 3	**WATER RESOURCES PROJECT ANALYSIS** Planning process and data needed for planning, Project analysis, Project optimality conditions and profitability analysis.	6
Unit 4	**WATER RESOURCES SYSTEM ENGINEERING** Concept of system engineering, Optimal policy analysis, Linear and dynamic programming, Integrated river basin development.	8
Unit 5	**APPLICATION OF SYSTEM APPROACH IN WATER RESOURCES** Application of system engineering in practical problems like hydrology, irrigation and drainage engineering, Mathematical models for forecasting and other water resources related problems.	10
Unit 6	**ECONOMIC AND FINANCIAL ANALYSIS OF WATER RESOURCES PROJECTS** Meaning and nature of projects economics theory, Micro and macroeconomics, Benefit cost analysis – cost and benefit curves, cost and benefit estimation, Discounting factors and techniques, Cost allocation and comparison of alternatives.	6

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Understand the planning and operation of reservoirs.
2	Apply the systems approach in analyzing the water resources systems.
3	Explore the applications of system engineering to practical problems in water resources engineering.
4	Assess the economic and financial aspects of a water resources project.

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Water Resources Systems Engineering", Hall, W. A., and Dracup, J. A., McGraw-Hill Book Company, New York.	2007
2	"Water resources Systems Planning And Management", Jain, S. K., and Singh, V. P., Elsevier.	2003
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Water Resources Systems Planning and Management– An introduction to methods, models and applications, Studies and Reports in Hydrology", Loucks, D.P. and Eelco van Beek, UNESCO Publishing.	2005
2	"Economics of Water Resources Planning", James, L. D., and Lee, R. R, McGraw-Hill.	2007
3	"Water Resources Systems Planning and Management", Chaturvedi, M. C., Tata McGraw-Hill Publishing Company.	2010
4	"Water Resources Systems", Vedula S., and Mujumdar P. P., Tata McGraw Hill.	2005

Sr. No	**Course link**	**Offered By**
1	https://nptel.ac.in/courses/105/108/105108081/- 'Water Resources Planning and Management'	**NPTEL**
2	https://nptel.ac.in/courses/105/108/105108130/ - 'Water Resources Systems: Modelling Techniques and Analysis'.	**NPTEL**

Equivalent MOOC courses

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

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Course Name	**:**	**Environmental Impact Assessment**	**DEC/MSC**
Course Code	**:**	**CEE104/CEM202**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:

The student should be able to

- identify various aspects of EIA processes
- interpret environmental management plans and EIA documents
- plan in accordance with the environmental legislation and acts, role of MOEFCC, pollution control boards/committees
- compare and evaluate different alternatives in a project/ activity

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO EIA** EIA origin, development, purpose and aims, core values and principles of EIA.	4
Unit 2	**LEGAL ASPECTS OF EIA** Environmental legislation in India, Environmental Appraisal procedures in India, EIA Gazette notifications of the year 1994, 2006 & thereafter, Environmental clearance process.	6
Unit 3	**PROJECT AND THE ENVIRONMENT DESCRIPTION** Environmental components of EIA, Identification of key issues, Terms of Reference, Baseline studies, Prediction and assessment of impacts on Air, Noise, Water, Soil & Geological, Biotic, Socio- economic, Cultural and Aesthetic environment.	8
Unit 4	**METHODS OF IMPACT ANALYSIS AND EVALUATION** Ad Hoc Methods, Checklists, Matrices, Networks, Environmental index, Cost Benefit analysis, Simulation methods, Overlays and GIS, and professional judgements etc. Aims and objectives of involvement of public and other stakeholders, Public involvement methods, approaches for EIA reviewing, Economic efficiency and valuation methods.	8
Unit 5	**ENVIRONMENTAL MANAGEMENT PLAN AND EIA DOCUMENTATION** Principles, Anticipated environmental impacts, Mitigation measures, Identification, comparison and evaluation of different alternatives, Mitigation measures, Preparation of EIA documents.	8
Unit 6	**CASE STUDIES OF EIA**	8

Course Outcomes: By the end of this course, the student will be able to:	
1	Decide the environmental requirements applicable to the environmental impact assessment, and the environmental clearance process of developmental projects
2	Evaluate the environmental impacts of developmental projects
3	Apply suitable methods and tools of prediction of environmental impacts
4	Recommend mitigation measures in environment management plan
5	Compare and evaluate different alternatives in a project

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Environmental impact assessment", L.W. Canter, McGraw Hill Co.	1996
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Environmental impact assessment", R.R. Barthwal, New Age International (P) Ltd. Publishers, New Delhi.	2002
2.	"Environmental impact assessment: Available Techniques and Emerging Trends", S.A. Abbasi & D.S. Arya, Discovery Publishing Pvt. Ltd.	Latest
3.	EIA Gazette Notifications such as SO 60 (E) dated 27-01-1994, MOEF, GOI, New Delhi. SO 1533 dated 14-09-2006, MOEF, GOI, New Delhi. SO 1199 (E) dated 23-03-2020, MOEFCC, GOI, New Delhi.	Latest

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/120/108/120108004/ - Environment Management**.**	NPTEL

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

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Course Name	**:**	**Reinforced Soil Analysis and Design**	**DEC**
Course Code	**:**	**CEE122**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:

The students should be able to:

- Understand the concepts of reinforced soil.
- Understand the different types and various applications of geosynthetic.
- Apply the knowledge of reinforced soil in the Civil Engineering field.
- Design the reinforced soil walls.

Total No. of Lectures: 42

Lecture-wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION** Basic concept of the Reinforced soil, Mechanism Design principles, Materials used for Construction, Advantages of reinforced soil.	04
Unit 2	**PRACTICAL APPLICATIONS** Reinforced soil in Civil Engineering structures, Basic components and strength characteristics of reinforced soil, Reinforced soil construction detailing.	06
Unit 3	**GEOSYNTHETICS** An overview of Geosynthetics, Description of Geotextiles, Geogrids, Geonets, Geomembranes, Geo-composites, Geocells-properties and test methods, Functions, Design methods for separation, stabilization, filtration, Drainage.	05
Unit 4	**RETAINING WALLS** Types of walls; Earth pressures for gravity/counterfort walls; structural design of wall and its foundation; stability of the wall-soil system; Slip circle analysis	04
Unit 5	**REINFORCED SOIL WALLS** Stability Analysis and construction aspects of Reinforced Soil Walls, Effect of reinforced sloped backfill on Soil wall design, Drainage design procedure**.**	06
Unit 6	**WALL WITH REINFORCED BACKFILL** Theoretical analysis, Pressure-Intensity on the wall, stability against sliding and overturning, Design procedure, Limitations of the analysis.	05
Unit 7	**FOUNDATIONS ON REINFORCED SOIL** Brief overview, Analysis of strip footing, isolated- square and rectangular footing on reinforced soil bed, Determination of Pressure Ratio.	06
Unit 8	**SOIL NAILING AND ANCHORS** Applications of Soil Nailing, Its components, Advantages and Limitations, Design aspects.	06

Course Outcomes (COs): By the end of the course, the students will be able to:	
1	Learn the characteristics of the different types of reinforcing material.
2	Choose appropriate reinforcement material.
3	Design the structures using reinforced soil.
4	Construct the various structures using the appropriate materials.

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Designing with Geosynthetics," Robert M. Koerner, Prentice Hall.	2012
2.	"Engineering with Geosynthetics," G.V Rao & GVS Suryanarayana Raju, Tata Mc GrawHill Publishing Co. New Delhi.	1990
3.	"Reinforced Soil and its Engineering Application," Swami Saran, New Age Publication.	2006
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Fundamentals of Geosynthetic Engineering," Shukla, S.K. and Yin, J.H., Taylor &Francis.	2006
2.	"Geotechnical Engineering," Gulati, S.K. and Datta, M. Tata Mc Graw Hill Publishing Co. New Delhi.	2005

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	https://nptel.ac.in/courses/105/106/105106052/NPTEL video course on Geosynthetics and Reinforced Soil Structures	NPTEL
2.	https://nptel.ac.in/courses/105/101/105101143/NPTEL video course on Geosynthetics Engineering: Theory and Practices	NPTEL

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

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Course Name	**:**	**Clean Technology**	**DEC**
Course Code	**:**	**CEE123**	
Credit	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives
The student should be able to • To analyse the prevailing clean technologies • To understand their design aspect • To develop knowledge of the concept • To apply principles of clean technology

Total No. of Lectures- 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**MASS AND ENERGY TRANSFER FUNDAMENTALS** Material balance, energy fundamentals, Environmental chemistry, Mathematics for resource consumption and population growth Introduction to energy science and energy technologies	10
Unit 2	**ENERGY AND THERMODYNAMICS** Earth and thermodynamics system, Global energy situation and system, fossil energy, Solar energy fundamentals and applications, Solar Photovoltaic system, Geothermal and Wind energy, Urban waste to energy conversion, Biomass energy, Energy storage system, Fuel Cells, Hydrogen and Methanol, Hydro energy, Energy and Environmental Audit**.**	10
Unit 3	**GREEN MATERIALS, GREEN BUILDINGS** Principles of Sustainability and Green Buildings, Design Features, Rating Systems Material, Energy Saving Features, Smart Cities.	7
Unit 4	**RISK ASSESSMENT** Perspective and Perception of risk, Risk assessment, Exposure assessment and Comparative risk analysis	7
Unit 5	**ENVIRONMENTAL LEGISLATIONS AND POLICIES** Environmental Laws, Air act, Water act, Environment act, Forest act, Environmental Impact assessment and management systems, International and National efforts for Environment Protection, Current Environmental Issues	8

Course Outcomes (COs): At the end of the course students will be able to:	
1	Choose technology options for sustainable development
2	Decide strategies for waste minimization and elimination.
3	Design clean technology systems.
4	Analyse green engineering practices in energy & manufacturing sector

Text Books:		
S. No.	**Name of Books/Author/Publisher**	**Year of Publications / Reprint**
1	"Clean Technology" Johansson Allan, Lewis Publisher	2022
2	"Introduction to Environmental Engineering and Science" Masters, G.M. and Ela WP, Pearson Education, Singapore	2001
Reference Books :		
S.no.	**Name of Books/Author/Publisher**	**Year of Publications / Reprint**
1	"Alternative building Materials and Technologies" Jagadish, K. S. Venkataramareddy B. U. New Age International	2007
2	" Renewable Energy for sustainable future", Godfrey Boyle, Oxford University Press	2012
3	"Energy Technology", Rao, S. & Parulekar, B.B, Khanna Publishers	2020

Equivalent MOOCs Courses

Sr.No.		Offered by
1	(https://www.edx.org/learn/environmental-science) world-bank-group-e-learning-course-on-greentech-mainstreaming-technologies-in-green-blue-and-clean-operations	EDX
2	(https://www.edx.org/course/enviromental-technologies-in-buildings)- Course on Sustainable Building Design.	EDX
3	(www.ciwmb.ca.gov/Greenbuilding/basics.htm#what)---Green Building Basics, California Integrated Waste Management Board	CIWMB

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

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OPEN ELECTIVE COURSES (OEC)

Course Name	**:**	**Disaster Management**	**OEC**
Course Code	**:**	**CEO101**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
• To analyze the causes and effects of various natural and man-made disasters. • To explore hazard and risk assessment. • To enable to plan various mitigation measures and capacity building. • To develop infrastructure for disaster management. • To apply applications of Remote Sensing in disaster mitigation.

Total No. of Lectures- 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO DISASTER MANAGEMENT** Natural Disasters, Man-made hazards, causes, consequences, earthquakes, Floods, Drought, Coastal Hazards, Landslides, rockslides and Forest Fires, Tsunamis, Oil spillage, Gas leakage, etc.	05
Unit 2	**DISASTER MITIGATION AND PREPAREDNESS** Mitigation measures for natural disasters- Earthquakes, Tsunamis, Cyclones, Floods, Landslides, etc.; Mitigation measures for various industrial hazards/disasters; Preparedness for natural disasters.	07
Unit 3	**HAZARD AND RISK ASSESSMENT** Assessment of capacity, vulnerability and risk; vulnerability and risk mapping; stages in disaster recovery and associated problems.	05
Unit 4	**EMERGENCY MANAGEMENT SYSTEMS** Emergency medical and essential public health services, response and recovery operations; Reconstruction and rehabilitation.	05
Unit 5	**CAPACITY BUILDING** Disaster management approach to inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, an overview of disaster management in India.	08
Unit 6	**INTEGRATION OF PUBLIC POLICY** Planning and design of infrastructure for disaster management; Community based approach in disaster management; Methods for effective dissemination of information; Ecological and Sustainable development models for disaster management.	06
Unit 7	**ROLE OF REMOTE SENSING IN DISASTER MITIGATION** Importance of Remote Sensing in disaster mitigation, Case studies	06

Course Outcomes:	
1	To annotate the causes and effects of various disasters.
2	To plan risk management/disaster mitigation techniques.
3	To evaluate the mitigation measures (Case study).
4	To demonstrate role of Remote Sensing in Disaster mitigation.

Textbooks:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication/ Reprint**
1.	"Elements of Earthquake Engineering," Jai Krishna, Chandrasekharan and B. Chandra, South Asian Publishers, New Delhi.	2000
2.	"Disaster Management," R.B. Singh (Ed), Rawat Publications.	2006
3.	"Disaster Management –Future Challenges & Opportunities," Jagbir Singh, I.K. International Publishing House.	2007
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication/ Reprint**
1.	"Natural Hazards in the Urban Habitat," Iyengar, C.B.R.I., Tata McGraw Hill. Publications.	1997
2.	"Natural Disaster Management," Jon Ingleton (Ed), Tudor Rose, Leicester.	1999
3.	"Earthquake Resistant Design of Structures," Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.	2006

Equivalent MOOCs courses:		
Sr. No.	**Course Links**	**Offered by**
1.	Natural Hazards https://onlinecourses.nptel.ac.in/noc20_ce07/preview	NPTEL
2.	Disaster Management https://archive.nptel.ac.in/courses/105/104/105104183/	NPTEL

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

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Course Name	**:**	**Green Buildings**	**OEC/MSC**
Course Code	**:**	**CEO102/CEM201**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:

The student should be able to

- understand basics of green design and sustainable development concept.
- understand guidelines for development and certification of green designs.
- identify different types of green building materials.
- understand the principles of effective energy and resource management in buildings.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**INTRODUCTION TO GREEN BUILDINGS** Sustainability, Principles of sustainable development, Definition of Green building, Building envelope, design features, Case Studies.	2
Unit 2	**GREEN BUILDINGS RATING SYSTEM & CODES** Energy codes (ECBC) requirement, Certification & Rating system for green buildings, green rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), Indian Green Building Council (IGBC)	4
Unit 3	**ENVIRONMENTAL IMPACT OF BUILDING MATERIALS** Building materials: sources, methods of production and their environmental impact, Material Efficiency, Embodied Energy in Building Materials, Operational energy in Building and Life cycle energy.	4
Unit 4	**INTRODUCTION TO GREEN MATERIALS** Local building materials, natural and renewable materials: bamboo, timber, rammed earth, stabilized mud blocks, materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste, reuse of waste and salvaged materials.	6
Unit 5	**THERMAL COMFORTS IN BUILDING** Heat Transfer Characteristic of Building Materials, Effect of Geographical Locations, Building Techniques related to thermal comfort.	5
Unit 6	**UTILITY OF SOLAR ENERGY IN BUILDINGS** Incidence of Solar Heat on Buildings, Concepts of Solar Cooling and Heating of Buildings, Low Energy Cooling, Solar PV system.	5
Unit 7	**DAYLIGHTING** Principles of light, transmission, reflection and absorption, illumination, day lighting concepts and its requirements.	5
Unit 8	**PLANNING FOR VENTILATION** Functions of ventilation, provision for air movement, air flow through buildings, orientation, external features, cross ventilation, position of openings, size of openings, humidity control.	5
Unit 9	**MANAGEMENT TECHNIQUES FOR GREEN BUILDINGS**	

	Energy conservation techniques, Water & waste-water management, solid management principles & techniques, indoor environmental quality measurements & improvement techniques.	6

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Apply principles and practices of green buildings and its standards.
2	Understand the importance of sustainable use of natural resources and energy.
3	Distinguish appropriate green building material and technique
4	Design sustainable and energy efficient civil engineering project.

Text Book:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Sustainable Construction: Green Building Design and Delivery," Charles J. Kibert, John Wiley & Sons	2012
2.	"Green Building Fundamentals," Mike Montoya, Pearson, USA	2010
Reference Books:		
Sr. No.	**Name of Book/Authors/Publisher**	**Year of Publication /Reprints**
1.	"Hand book of Green building Design and construction," Sam Kubba, Elsevier Architecture Press.	2010
2.	"Green building: principals and practice in residential construction," Abe Kruger and Carl Seville, Cengage Learning.	2012
3.	"Alternative building materials and technologies", K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, New age international publishers	2007
4.	"Sustainable Construction and Design", Regina Leffers, Pearson/ Prentice Hall, USA	2009
5.	IGBC Green New building rating system (Version 3.0)	2015
6.	Energy Conservation Building Code. Bureau of Energy Efficiency.	2018
7.	Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi	2004

Equivalent MOOCs courses

Sr. No.	**Course Links**	**Offered by**
1.	(https://archive.nptel.ac.in/courses/105/102/105102195/)- Sustainable Materials & Green Buildings, IIT Delhi	NPTEL
2.	(https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ar03/)- Sustainable Architecture, IIT Roorkee	NPTEL

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

1 – Slight (Low) Correlation
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Course Name	**:**	**Clean Technology**	**OEC**
Course Code	**:**	**CEO103**	
Credit	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives
The student should be able to • To analyse the prevailing clean technologies • To understand their design aspect • To develop knowledge of the concept • To apply principles of clean technology

Total No. of Lectures – 42

Lecture-wise break-up:		**No. of Lectures**
Unit 1	**MASS AND ENERGY TRANSFER FUNDAMENTALS** Material balance, energy fundamentals, Environmental chemistry, Mathematics for resource consumption and population growth Introduction to energy science and energy technologies	10
Unit 2	**ENERGY AND THERMODYNAMICS** Earth and thermodynamics system, Global energy situation and system, fossil energy, Solar energy fundamentals and applications, Solar Photovoltaic system, Geothermal and Wind energy, Urban waste to energy conversion, Biomass energy, Energy storage system, Fuel Cells, Hydrogen and Methanol, Hydro energy, Energy and Environmental Audit**.**	10
Unit 3	**GREEN MATERIALS, GREEN BUILDINGS** Principles of Sustainability and Green Buildings, Design Features, Rating Systems Material, Energy Saving Features, Smart Cities.	7
Unit 4	**RISK ASSESSMENT** Perspective and Perception of risk, Risk assessment, Exposure assessment and Comparative risk analysis	7
Unit 5	**ENVIRONMENTAL LEGISLATIONS AND POLICIES** Environmental Laws, Air act, Water act, Environment act, Forest act, Environmental Impact assessment and management systems, International and National efforts for Environment Protection, Current Environmental Issues	8

Course Outcomes (COs): At the end of the course students will be able to:	
1	Choose technology options for sustainable development
2	Decide strategies for waste minimization and elimination.
3	Design clean technology systems.
4	Analyse green engineering practices in energy & manufacturing sector

Text Books:

S. No.	Name of Books/Author/Publisher	Year of Publications /Reprint
1	"Clean Technology" Johansson Allan, Lewis Publisher	2022
2	"Introduction to Environmental Engineering and Science" Masters, G.M. and Ela WP, Pearson Education, Singapore	2001
Reference Books :		
S.No.	**Name of Books/Author/Publisher**	**Year of Publications /Reprint**
1	"Alternative building Materials and Technologies" Jagadish, K. S. Venkataramareddy B. U. New Age International	2007
2	" Renewable Energy for sustainable future", Godfrey Boyle, Oxford University Press	2012
3	"Energy Technology", Rao, S. & Parulekar, B.B, Khanna Publishers	2020

Equivalent MOOCs Courses

Sr.No.		Offered by
1	(https://www.edx.org/learn/environmental-science) world-bank-group-e-learning-course-on-greentech-mainstreaming-technologies-in-green-blue-and-clean-operations	EDX
2	(https://www.edx.org/course/enviromental-technologies-in-buildings)-Course on Sustainable Building Design.	EDX
3	(www.ciwmb.ca.gov/Greenbuilding/basics.htm#what)---Green Building Basics, California Integrated Waste Management Board	CIWMB

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

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MINOR SPECIALIZATION COURSES

Course Name	**:**	**Structural Analysis And Design**	**MSC**
Course Code	**:**	**CEM101**	
Credits	**:**	**4**	
L T P	**:**	**3 0 2**	

Course Objectives :
At the end of this course, the student should be able to: • Understand the concepts of material behavior and their application in structural analysis. • Analyze fundamental structural elements such as beams, columns, and trusses. • Design simple reinforced concrete and steel structures.

Total No. of Lectures – 42

Lecture wise breakup		**No. of Lectures**
Unit 1	**SIMPLE STRESSES & STRAINS** Concept of stresses and strains, relationship between elastic constants, extension of uniform bar under its own weight and due to load applied, stresses produced in compound bars due to axial to loads, thermal stresses.	4
Unit 2	**SHEAR FORCE, BENDING MOMENT AND DEFLECTION IN BEAMS** Shear force, bending moment, Relation between load, SF and BM, SFD , BMD and axial force diagram for determinate beams under various types of loading, Slope and Deflection in beams by double integration method, Macaulay's method under the action of various loading conditions.	8
Unit 3	**BENDING AND SHEAR STRESSES IN BEAMS** Pure bending ,bending stresses, Variation of shear stresses for various cross-sections of a beam.	5
Unit 4	**BUILDING MATERIALS** Introduction to various type of commonly used material- stones, bricks, cement, concrete, steel, wood, their properties and applications.	7
Unit 5	**INTRODUCTION TO DESIGN OF RCC STRUCTURES** Properties of Concrete, Design Philosophies, Design of simple beams, slabs, columns and isolated footings.	9
Unit 6	**INTRODUCTION TO DESIGN OF STEEL STRUCTURES** Steel as construction Material, Design concepts of tension, compression and flexural steel members and connections. Introduction to design of roof trusses.	9

List of Experiments:		**Number of Turns**
1	To determine standard consistency of cement and its Setting Time.	2
2	To determine Fineness of Cement.	1
2	To determine Specific Gravity of Cement.	1
3	To determine Compressive Strength of Cement.	2

4	To determine Water absorption and Efflorescence of Bricks	2
5	To determine Compressive Strength and Hardness of Bricks.	2
7	To determine bulk density and voids of fine and coarse aggregates.	2
8	To determine fineness modulus and grain size distribution of fine and coarse aggregates.	2
Course Outcomes: At the end of this course, the student will be able to:		
1	Analysis simple structures under different loading conditions.	
2	Understand the use of various construction materials.	
3	Design simple reinforced concrete elements.	
4	Design simple steel structural elements.	

Text Book:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Mechanics of Materials", Punmia and Jain, Laxmi Publications (P) Ltd.	2017
Reference Books:		
Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication / Reprint**
1	"Mechanics of Materials", R.C.Hibbeler, Pearson Higher Education	2018
2	"Structural Analysis", R.C. Hibbeler, Prentice Hall of India Pvt. Ltd.	2021
3	"Limit state design of Reinforced Concrete", Punmia and Jain (Vol.II), Laxmi Publications.	2016
5	"Limit state design of Steel Structures", S.K. Duggal, Tata McGraw Hill. Publications.	2017
6	"Reinforced Concrete Limit State Design"' A.K.Jain, Nem Chand and Bros.	2012

Equivalent MOOCs Courses

Sr. No.	**Course Links**	**Offered by**
1	(https://archive.nptel.ac.in/courses/105/105/105105166/)---Structural analysis I, IIT Kharagpur	NPTEL
2	(https://archive.nptel.ac.in/courses/105/101/105101086/)--- Structural analysis II, IIT Bombay	NPTEL

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

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Course Name	**:**	**Intelligent Transportation Systems**	**MSC**
Course Code	**:**	**CEM102**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:

- To make the students understand the transportation system engineering processes along with describing the concepts of transport system architecture and their evolution and to make students understand the capability of key technologies.
- Develop a solid understanding of the key concepts, components, and technologies that form the foundation of Intelligent Transportation Systems.
- Study vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication systems, and their role in improving traffic safety and efficiency.
- Learn to collect, process, and analyze transportation data from various sources, including sensors, cameras, and GPS devices, to make informed decisions.

Total No. of Lectures - 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS** Intelligent Transportation Systems (ITS), Advanced Traveller Information Systems (ATIS)	4
Unit 2	**COMPONENTS OF ITS** ITS Standards and Architecture; Organizational structure	4
Unit 3	**TELECOMMUNICATIONS** ITS Telecommunications	4
Unit 4	**ITS TECHNOLOGY** Interactive Voice Recognition (IVR), automated highway systems (AHS); sensors, electronic toll collection (ETC); dedicated short range communication and standards.	4
Unit 5	**APPLICATION ON PUBLIC TRANSPORT** Expected Time of Arrivals, Electronic Ticketing Machines, Automated Vehicle Location.	5
Unit 6	**APPLICATIONS TO HIGHWAY SAFETY** ITS Highway Safety Perspective	4
Unit 7	**APPLICATIONS TO ENVIRONMENT ASPECTS** Environmental Aspects of ITS; Connected Vehicle Technology and Applications	5
Unit 8	**SECURITY** ITS and Security; ITS Policy Issues	3
Unit 9	**ECONOMICS** Economics of ITS – Revenue Generation Models	4
Unit 10	**CASE STUDIES** Applications in bus transport, metro and highways	5

Course Outcomes (COs): At the end of the course the students will be able to:	
1	Understand the impact of technology on different modes and movement.
2	Select appropriate ITS technology depending upon site-specific conditions.
3	Differentiate different user services.
4	Understand the systems engineering application in ITS and ITS architecture

Suggested Textbooks:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Intelligent Transport Systems" Sarkar P.K. and Jain A.K. PHI Learning	2018

Reference Book:		
Sr. No	**Name of Book / Authors/Publisher**	**Year of Publication/ Reprints**
1.	"Perspectives on Intelligent Transportation Systems" Sussman, J.M.() Springer,Berlin.	2010
2.	"Intelligent Transportation Systems: New Principles and Architectures" Ghosh, S., Lee, T.S., CRC Press.	2000
3.	Fundamentals of IntelligentTransportation Systems Planning, Mashrur A. Chowdhury, and Adel Sadek,Artech House, Inc.	2003

Equivalent MOOC courses

Sr. No	**Course link**	**Offered By**
1	https://www.civil.iitb.ac.in/~vmtom/nptel/591_ITS_1/web/web.html 'Introduction to Intelligent transportation systems - I'.	NPTEL
2	https://www.civil.iitb.ac.in/tvm/nptel/592_ITS_2/web/web.html - Introduction to Intelligent transportation systems -II'.	NPTEL

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

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Course Name	**:**	**Water and Waste Water Engineering**	**MSC**
Course Code	**:**	**CEM103**	
Credits	**:**	**4**	
L T P	**:**	**3 1 0**	

Course Objectives:
The student should be able to • Impart up-to date know of water pollution • Understand the basic principles of water and waste-water pollution • Design various pollution control strategies for water • Design various pollution control waste-water

Total No. of Lectures - 42

Lecture-wise break-up		**No. of Lectures**
Unit 1	**WATER SUPPLY** Introduction; Need for and importance of public water supply, water quality standards for drinking water (BIS & WHO) standards, ill effectof contaminated waters on human health.	4
Unit 2	**TREATMENT OF WATER - I** Objectives, various treatments methods, sedimentation – theory and principle involved, various types of settlings, design of type-I (discrete settling) sedimentation tanks, sedimentation aided with coagulation and flocculation, chemistry of coagulation, different types ofcoagulants, design of mixing, flocculation tank and clarifiers, filtration theory and mechanism, compression between slow and rapid sand filters, design criteria, design of rapid sand filters. Water disinfection, various methods, disinfection by chlorination and its various forms, brake point chlorination. Miscellaneous treatment Water softening objective, different methods of water softening, lime& soda process, zeolite process etc.	15
Unit 3	**WASTE-WATER TREATMENT** Introduction and need of waste-water treatment, implications of disposal of waste on rivers and land. Waste-water treatmentmethods – preliminary, primary, secondary, and tertiary treatment methods, hydraulic flow chart of a conventional sewage treatment plants, design of screening chambers, grit chambers, skimming tanks and primary settling tanks, biological treatment and various methods, tertiary treatment. detail and design criteria, oxidation ponds and ditches.	15
Unit 4	**SEWAGE DISPOSAL** Disposal methods for sewage, land, river and lake disposal, self purification of rivers and streams, zone of pollution in rivers, D.O. deficit and oxygen sag, kinetics of D.O. deficit (streeter – phelps equation) and its applications; Disposal of sewage on land – disposal and it's implications, sewage sickness, disposal in lakes and sea.	4
Unit 5	**SLUDGE TREATMENT AND DISPOSAL**	4

Course Outcomes (COs): By the end of this course the student will be able to:	
1	Propose the water supply system and treatment.
2	Design the waste water facilities.
3	Explain the concept of wastewater disposal and management.
4	Explain the concept of sludge treatment and management

Text Books :		
Sr. No.	**Name of Books/Author/Publisher**	**Year of Publications/ Reprint**
1	"Environmental Engineering", Howard S. Peavy, D.R. Rowe, G. Tchobanglous, McGrawHill Book Co., New Delhi	1985
2	"Environmental Engineering -1 Water Supply Engineering", Santosh Kumar GargKhanna Publishers, New Delhi	2010
Reference Books :		
Sr. No.	**Name of Books/Author/Publisher**	**Year of Publications/ Reprint**
1	"Environmental Engineering–A Design Approach", A P Sincero, G A Sincero, PHI, New Delhi,(EEE Edition)	1996
2	"Manual on Water Supply Engineering", Expert Committee Ministry of urbanDevelopment, New Delhi	1993
3	"Environmental Engineering-1 (Water Supply Engineering)", B.C. Punia, A.K. Jain & A.K. Jain Laxmi Publication, New Delhi	1995

Equivalent MOOCs Courses

Sr. No.		**Offered by**
1	https://nptel.ac.in/courses/105/104/105104102/ - video course on 'Water andWaste Water Engineering'.	NPTEL
2	https://nptel.ac.in/courses/105/106/105106119/ - video course on 'Water andWaste Water Engineering'	NPTEL
3	https://nptel.ac.in/courses/105/105/105105178/ - video course on 'Waste waterTreatment and Recycling'	NPTEL
4	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ce23/ - video course on 'Water Supply Engineering'	NPTEL

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

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