

Course Curriculum for B. Tech. (New)

in

Civil Engineering

(For students admitted in 2019-20 onwards)



Civil Engineering Department

National Institute of Technology

Arunachal Pradesh

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Proposed curriculum (Civil Engineering Department -NITAP)

1. Semester wise credit point distribution

Sl. No.	Year	Credit Point	
		ODD	EVEN
1	First	18.5	20.5
2	Second	23	20
3	Third	20	21
4	Fourth	19	18
Total Credit Point		77.5	82.5
		160	

2. Category wise Credit point Distribution

Course Category	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem-VI	Sem-VII	Sem-VIII	Total Credit Point
Core (Basic Science)	7	10	4	--	--	--	--	--	21
Core (Engineering Science)	6	3	--	--	--	--	--	--	9
Core (Professional)	--	--	12	12	17	18	12	--	71
Core (Humanities)	3	3	3	3	--	--	--	--	12
Elective (Professional)	--	--	--	--	--	--	3	--	3
Open Elective	--	--	--	--	--	--	3	--	3
Elective (online course)	--	--	--	--	--	--	--	6	6
Lab (Basic Science)	1	1	--	--	--	--	--	--	2
Lab (Engineering Science)	1.5	3.5	--	--	--	--	--	--	5
Lab (Humanities)	--	--	--	--	--	--	--	--	--
Lab (Professional)	--	--	4	5	2	2	--	--	12
Internship	--	--	--	--	1	1	1	--	3
Academic Project	--	--	--	--	--	--	--	10	10
Audit (NSS/NCC)	0	0	--	--	--	--	--	--	0
Grand Viva	--	--	--	--	--	--	--	2	2
Total Credit Point	18.5	20.5	23	20	20	21	19	18	160

Proposed curriculum (Civil Engineering Department -NITAP)

3. Course Structure

IIIrd Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-201	Building Planning, Construction Technology and Material	3	0	0	3
2	CE-202	Surveying - I	2	1	0	3
3	CE-203	Structural Mechanics	2	1	0	3
4	CE-204	Fluid Mechanics - I	2	1	0	3
5	CE-205	Surveying Laboratory - I	0	0	2	1
6	CE-206	Applied Mechanics Laboratory	0	0	2	1
7	CE-207	Fluid Mechanics Laboratory - I	0	0	2	1
8	CE-208	Building Material Testing Laboratory	0	0	2	1
9	MA-201	Probability and Statistics	3	1	0	4
10	MH-201	Introduction to Human Values and Ethics	3	0	0	3
Contact Hours			15	4	8	
Total Credits						23
IVth Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-209	Fluid Mechanics - II	2	1	0	3
2	CE-210	Surveying - II	2	1	0	3
3	CE-211	Transportation Engineering - I	2	1	0	3
4	CE-212	Structural Analysis - I	2	1	0	3
5	CE-213	Surveying Laboratory - II	0	0	3	1.5
6	CE-214	Civil Engineering Drawing	0	0	3	1.5
7	CE-215	Structural Engineering Laboratory	0	0	2	1
8	CE-216	Transportation Engineering Laboratory - I	0	0	2	1
9	MH-206	Entrepreneurship	3	0	0	3
Contact Hours			11	4	10	
Total Credits						20
Vth Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-301	Design of RCC Structures - I	3	0	0	3
2	CE-302	Geotechnical Engineering - I	2	1	0	3
3	CE-303	Transportation Engineering - II	3	0	0	3
4	CE-304	Concrete Technology	3	0	0	3
5	CE-305	Water Resources Engineering	2	1	0	3
6	CE-306	Engineering Geology	2	0	0	2
7	CE-307	Geotechnical Engineering Laboratory - I	0	0	2	1
8	CE-308	Concrete Technology Laboratory	0	0	2	1
9	CE-309	Internship - I	0	0	0	1
Contact Hours			15	2	4	
Total Credits						20

Proposed curriculum (Civil Engineering Department -NITAP)

VI th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-310	Design of RCC Structures - II	3	0	0	3
2	CE-311	Geotechnical Engineering - II	2	1	0	3
3	CE-312	Structural Analysis - II	3	0	0	3
4	CE-313	Environmental Engineering - I	3	0	0	3
5	CE-314	Design of Steel Structures - I	2	1	0	3
6	CE-315	Irrigation and Hydraulic Structures	3	0	0	3
7	CE-316	Environmental Engineering Laboratory - I	0	0	2	1
8	CE-317	Geotechnical Engineering Laboratory - II	0	0	2	1
9	CE-318	Internship - II	0	0	1	1
Contact Hours			16	2	5	
Total Credits						21
VII th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-XXX	Open Elective - Engineering Hazard Analysis and Control	3	0	0	3
2	CE-401	Construction Planning and Management	3	0	0	3
3	CE-402	Design of Steel Structures - II	3	0	0	3
4	CE-403	Environmental Engineering - II	3	0	0	3
5	CE-404	Estimation, Contract and Valuation	0	0	0	3
6	CE-405	Elective - I	3	0	0	3
7	CE-406	Internship - III	0	0	0	1
Contact Hours			15	0	0	
Total Credits						19
VIII th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-403X	Elective - II (NPTEL/SWAYAM/MOOC)	3	0	0	3
2	CE-404X	Elective - III (NPTEL/SWAYAM/MOOC)	3	0	0	3
3	CE-498	Project and Dissertation	0	0	20	10
4	CE-499	Grand Viva	0	0	0	2
Contact Hours			6	0	16	
Total Credits						18

4. List of subjects offered under Elective-I

Sl. No.	Course Code	Course title	L	T	P	C
1	CE 405A	Foundation Engineering	3	0	0	3
2	CE 405B	Traffic Engineering	3	0	0	3
3	CE 405C	Environmental Impact Assessment and Modelling	3	0	0	3
4	CE 405D	Advanced Structural Analysis	3	0	0	3
5	CE 405E	Municipal Solid Waste Management	3	0	0	3
6	CE 405F	Ground water Engineering	3	0	0	3

Proposed curriculum (Civil Engineering Department -NITAP)

7	CE 405G	Earthquake Resistant Design	3	0	0	3
8	CE 405H	Theory of Plate and Shell	3	0	0	3
9	CE 405J	Remote Sensing and GIS	3	0	0	3

5. Open elective (offered by other department)

- ❖ Students are free to choose any subjects of their interest offered as open electives by other department of the Institute.
- ❖ The course has to be of 3 credits.
- ❖ During the beginning of the 7th semester, HoD will notify the specific subject offered as an open elective for other departments.

6. Elective-II & III

- ❖ These two courses will be chosen from NPTEL (<https://nptel.ac.in/>)/SWAYAM portal (<https://swayam.gov.in>).
- ❖ Student can enrol in 4th year (7th & 8th semester). However the courses will be credited in 8th semester only.
- ❖ Courses will be of completely student's choice and should be of at least of 12 weeks including tutorials which will be considered as 3 credit course.
- ❖ The choice of courses should be from outside the core and electives offered/opted.

7. Internship

- ❖ Internship-I: Student will go for internship during summer vacation (after 4th semester) for a period of 4 weeks. The assessment will be done on 5th semester
- ❖ Internship-II: Student will go for internship during winter vacation (after 5th semester) for a period of 4 weeks. The assessment will be done on 6th semester
- ❖ Internship-III: Student will go for internship during summer vacation (after 6th semester) for a period of 4 weeks. The assessment will be done on 7th semester
- ❖ At least one internship has to be done in Industry preferably during Internship-III.

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III rd Semester						
SI No	Course Code	Course Title	L	T	P	C
1	CE-201	Building Planning, Construction Technology and Material	3	0	0	3
2	CE-202	Surveying - I	2	1	0	3
3	CE-203	Structural Mechanics	2	1	0	3
4	CE-204	Fluid Mechanics - I	2	1	0	3
5	CE-205	Surveying Laboratory - I	0	0	2	1
6	CE-206	Applied Mechanics Laboratory	0	0	2	1
7	CE-207	Fluid Mechanics Laboratory - I	0	0	2	1
8	CE-208	Building Material Testing Laboratory	0	0	2	1
4	MA-201	Probability and Statistics	3	1	0	4
5	MH-201	Introduction to Human Values and Ethics	3	0	0	3
Contact Hours			15	4	8	
Total Credits						23

Subject Code	Subject	L	T	P	C
CE-201	Building Planning, Construction Technology and Material	3	0	0	3

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

1. Classify and characterize stones
2. Comprehend the manufacturing process of bricks, lime and cement
3. Recognize the preservation methods of timber and metals
4. Understand the use of non-conventional Civil Engineering materials

Course content:

1. Functional Planning of Buildings:

Planning Principles of Buildings, Orientation of Buildings, Built Environment, Functional Planning – Lighting, Heating, Ventilation, and Climate factors, Building Service – Circulation, Plumbing, Electrification and Sanitation. Layouts-Residential, Auditorium, Cinema Hall, Studio.

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

2. **Cement:** Introduction, Portland cement, Chemical composition of raw materials, composition of cement clinker, hydration, rate of hydration, manufacturing, physical characteristics, properties of cement compounds
3. **Aggregate:** Introduction, classification, characteristics, deleterious substances, soundness, thermal properties, fine aggregate, coarse aggregate, testing of aggregates, Influence of aggregate on the properties of concrete, aggregate selection

4. **Foundation:** Function of a foundation, requirements of a good foundation, Types of foundations, Shallow foundation, Deep foundations
5. **Masonry :** Stone Masonry, Classification of stone masonry, Dressing of stones, safe permissible loads on stones, Brick masonry: Types of bricks, stretcher bond, header bond, English bond, Flemish bond etc. brick laying, tools for brick laying ,bonds in-connections, brick piers, footings, defects in brick masonry, Tools for brick laying, strength of brick masonry, ornamental brick work, Composite masonry, brick-stone composite masonry
6. **Walls:** Load bearing Walls-Design considerations, lateral support ,effective height of wall, Cavity walls-features, wall ties, construction of cavity walls, Partition walls-brick partition ,clay block partition walls, concrete partition lass partitions wood slab partition etc.
7. **Floors: Ground floor-**Components of a floor, Materials for construction, selection of flooring materials mud flooring ,brick flooring, cement concrete flooring ,terrazzo flooring ,mosaic flooring ,tiled flooring ,timber flooring etc, Upper floor: steel joist and stone or precast concrete slab floors ,jack arch floors ,reinforced cement concrete floors
8. **Lintels and arches:** Classification of Lintels, timber lintels, stone lintels, reinforced cement concrete lintels, types of arch, stability of arch, classification of arch
9. **Stairs:** Requirements of a good stairs, dimension of steps, classification of stairs
10. **Roof and Roof coverings:** Types of roof- pitched roof, double or purlin roofs, trussed roofs, flat terraced roofing
11. **Doors and windows:** Location of doors and windows, Size of doors, door frames, types of doors, windows, types of windows, ventilators
12. **Plastering and Pointing:** Types of mortars for plastering, tools for plastering, Number of coats for plaster, Methods of plastering, defects in plastering
13. **Painting, Distempering and Whitewashing:** Characteristics of an ideal paint, constituents of a paint, classification and type of paints, defects in painting, Varnishing, Distempering, whitewash and colour washing
14. **Damp proofing:** Causes of dampness, effect of dampness, methods of damp proofing, materials used for damp proofing courses, D.P.C treatment in buildings.

Books:

1. Duggal, S.K, (2008), Building Materials, Third Revised Edition, New Age International (P) Limited Publishers.
2. Peter A. Claisse, (2016), Civil Engineering Materials, Butterworth-Heinemann (Imprint of Elsevier). Copyright © 2016 Elsevier Ltd.
3. Haimei Zhang, (2011), Building Materials in Civil Engineering, Woodhead Publishing Limited and Science Press.
4. Swamy and Rao., “Building Planning and drawing”,Chaorator Publications
5. Bhavikatti and Chitawadagi., “Building Planning and drawing”,I.K publications
6. B.C Punmia., “Building construction Technology”, Laxmi Publications

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-202	Surveying - I	2	1	0	3

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

1. Should be able to understand the basic of surveying.
2. Should be aware of the role of surveying in the site investigation before carrying out any construction work.
3. Will be able to understand the methods of chain and compass surveying
4. The concepts of levelling and contouring will be clear.
5. Will have the knowledge of various surveying equipments and their uses such as Theodolite, compass, plane table etc.

Course content:

1. **Introduction:** Definition of surveying, primary divisions of surveying, object and classification of surveying, principles of surveying, approximate methods of chine and tape surveying, unfolding and folding of a chain, instruments for chaining and taping, measurement by tape and chain, errors in tape measurements and their corrections, testing and adjusting of a chain, chaining on flat and sloping ground, obstacle in chaining, direct and indirect methods of ranging, methods of traversing, principle basic definitions, bearings and meridians, prismatic compass, surveyors compass, azimuthal and quadrantal bearing systems, true north and magnetic north, magnetic declination, local attraction and its correction.
2. **Levelling and contouring:** Definition of terms, principles of levelling, types of levels, levelling staffs, booking and reduction in field book, balancing of sights, errors curvature and refraction, distance of visible horizon, reciprocal levelling, and its merits, contour, contour interval, horizontal equivalent, contour gradient, factors affecting contour interval, characteristics of contours, direct and indirect methods of contouring, uses of contour maps.
3. **Theodolite:** Vernier and microscopic theodolite, construction, temporary and permanent adjustments, measurements of horizontal and vertical angles, methods of repetitions and reiteration, sources of errors, checks in traversing, omitted measurements.
4. **Plane table surveying:** Principles, merits and demerits, instruments and other accessories, methods used, radiation, traversing, resection, intersection and their uses, two and three point problem.
5. **Areas and volume:** Measurement of Area, Computation of area by Geometrical Figure, Area of offsets, Area from co- ordinates, Area by planimeter, Digital Planimeter

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

Books:

1. K.R. Arora. "Surveying Volume-I" Standard Publishers Distributors, 2010
2. B.C. Punmia, A. K.. Jain & A.K. Jain, "Surveying Volume-I" Laxmi Publications, 2005
3. R.Agor "Surveying and Levelling", Khanna Publishers. New Delhi,1996
4. S.K.Duggal "Surveying Volume-I",Tata McGraw Hill Publisher,New Delhi,2004
5. Kanetkar and Kulkarni "Surveying and Levelling" Pune Vidyarthi Griha Prakashan,Pune,1985

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-203	Structural Mechanics	2	1	0	3

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

1. Analyse the statically determinate and indeterminate problems
2. Determine the stresses and strains in the members subjected to axial, bending and tensional loads
3. Evaluate the slope and deflection of beams subjected to loads
4. Determine the principal stresses and strains in structural members

Course content:

1. **Tensile, compressive and shear stresses** - Hooke's law - elastic constants - compound stresses - composite bars - thermal stresses.
2. **Strain Energy due to axial force** - Resilience - stresses due to impact and suddenly applied load - Principal stress and principal planes - Mohr's circle
3. **Beams and support conditions** -Types of supports and loads - shear force and bending moment - their diagrams for simply supported beams, cantilevers and overhanging beams. Theory of simple bending – Bending stress and shear stress distribution - strain energy principles.
4. **Analysis of plane truss** - Method of joints - Method of sections
5. **Thin cylinders and shells**- Theory of torsion - Torsion of circular and hollow circular shafts and shear stresses due to torsion - closed and open coiled helical springs - leaf spring.

Books:

1. Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi, 1996.
2. T.D. Gunneswra Rao and Mudimby Andal, Strength of Materials - Fundamentals and Applications, Cambridge University Press, 1st Edition, 2018.
3. Beer and Johnston, Mechanics of Materials, McGraw Hill International Edition, 1995.
4. E.P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Pvt. Ltd., 1998.

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-204	Fluid Mechanics - I	2	1	0	3

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

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

Course content:

1. **Introduction:** Purpose of study of fluid mechanics in the fields of Civil and other Engineering. Fundamental difference between a solid and a fluid, constituent relationship for solids and fluids, conservation principles applied in fluid mechanics.
2. **Properties of fluids:** viscosity, compressibility, ideal and real fluids, Newtonian and non Newtonian fluids, surface tension.
3. **Pressure at point,** Pascal's law, Stress at a point, Variation of pressure with elevation in compressible and incompressible fluids, hydrostatic law, Pressure measurement, piezometers and manometers, buoyancy, stability of submerged and floating bodies.
4. **Fluid flow:** with reference to translation, rotation and deformation, concept of continuum, control mass & control volume approach, Reynolds transport theorem.
5. **Velocity field,** one & two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, equipotential lines, standard flow patterns, combination of flow patterns, flow net method, use and limitations
6. **Forces exerted in a fluid flow,** derivation of Continuity equation and Euler's equation, Bernoulli's equation and its applications, Momentum equation and its applications
7. **Measurement of flow in pipes and open channels,** orifice, mouthpiece, orificemeter and venturimeter, weirs and notches
8. **Laminar flow and its characteristics,** Navier-Stokes equations - exact solutions, Laminar flow between parallel plates, Laminar flow through pipes, Hazen-Poiseuille equation, Reynolds experiment, head loss in flow through pipes, Darcy Weisbach equation, losses in pipe transitions, Turbulence, Prandtl's mixing length theory
9. **Dimensional Analysis:** Dimensional homogeneity, Non Dimensional parameter, Π theorem, dimensional analysis, choice of variables, Reyleigh methods

Books:

1. F M White, Fluid Mechanics, Tata McGraw Hill Publication 2011.
2. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, Introduction to Fluid Mechanics, Student Edition Seventh, Wiley India Edition, 2011.
3. Shames, Mechanics of Fluids, McGraw Hill Book Co., New Delhi, 1988.
4. Streeter V.L., Benjamin Wylie, Fluid Mechanics, McGraw Hill Book Co., New Delhi, 1999.

Subject Code	Subject	L	T	P	C
CE-205	Surveying Laboratory - I	0	0	2	1

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

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

List of Practicals:

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

Books:

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2015.
2. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.

Proposed curriculum (Civil Engineering Department -NITAP)

3. Chandra A. M., Plane Surveying, New Age International Publ., 2007.
4. James, M Anderson & Edward M Mikhail., Surveying Theory and Practice, Tata Mc Graw Hill, 2012.
5. Charles D Ghilani, Paul R Wolf., Elementary Surveying, Prentice Hall, 2012.

Subject Code	Subject	L	T	P	C
CE-206	Applied Mechanics Laboratory	0	0	2	1

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

1. Understand the different physical properties of construction materials.
2. Understand modern technique of Non-Destructive methods.
3. Understand the use of universal testing machine (UTM).

List of Practicals:

1. To determine hardness of material with the help of the following methods:
 - i. Rockwell test
 - ii. Brinell test
 - iii. Vickers
2. To determine the impact strength of materials with the help of pendulum type impact testing machine.
3. To determine tensile properties of ductile material with the help of Universal testing machine (UTM).
4. To determine the compressive properties of non-ductile materials with the help of UTM.
5. To determine the compressive strength of brittle materials with the help of compressive testing machine.
6. To perform various types of non-destructive tests and thus obtain various properties of materials.
7. To determine the creep and fatigue of a material using Creep testing and Fatigue testing machine.

Books:

1. S Ramamrutham, "Strength of materials", Dhanpat Rai Publishing Company.
2. Dr R K Bansal, "A Text Book of Strength of Materials", Laxmi Publications (P) Ltd.
3. L C Singal and N D Sharma "Strength of materials", Modern Publishers
4. S Subramanian, "Strength of Materials", Oxford University Press.

Proposed curriculum (Civil Engineering Department -NITAP)

5. Beer, Johnston, “Mechanics of Materials”, Tata McGraw-Hill Publications.
6. Timosanko, “Strength of materials” ,Van Nostrand .
7. Rattan, “Strength of materials”, TMH.
8. G.H.Ryder, Mc Millan, “Strength of Material”, ELBS Edition.
9. Nash, “Strength of Materials”, Schaum series, MGH.
10. Timoshenko & Young , “Elementary of strength of material “ , Tata Mc Graw Hill.

Subject Code	Subject	L	T	P	C
CE-207	Fluid Mechanics Laboratory - I	0	0	2	1

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

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

List of Practicals:

1. Discharge measurement using Venturimeter
2. Discharge measurement using Orifice and mouthpiece
3. Discharge measurement using triangular notch and rectangular notch
4. Determination of Darcy’s friction factor, relative roughness for laminar and turbulent flows
5. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
6. Minor Losses in a Pipeline

Books:

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

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-208	Building material testing Laboratory	0	0	2	1

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

1. Know the various test related to building construction materials
2. Understand the function of various equipments used for testing materials
3. After conducting the test, ranges of various parameters given by IS code will be known.

List of practicals:

1. Laying and sketching of header and stretcher brick bonds
2. Laying and sketching of English and Flemish brick bonds
3. To Determine the fineness of cement.
4. To Determine the standard consistency of cement.
5. To Determine the Initial and Final setting time cement.
6. Fineness modulus of coarse aggregate by sieve analysis.
7. Fineness modulus of fine aggregate by sieve analysis.
8. To Determine the workability of fresh concrete by Slump Cone Test.
9. To Determine the workability of fresh concrete by Vee Bee consistometer Test.
10. To Determine the workability of fresh concrete by Flow Table Test Test.

Books:

1. Duggal, S.K, (2008), Building Materials, Third Revised Edition, New Age International (P) Limited Publishers.
2. Peter A. Claisse, (2016), Civil Engineering Materials, Butterworth-Heinemann (Imprint of Elsevier). Copyright © 2016 Elsevier Ltd.
3. Haimei Zhang, (2011), Building Materials in Civil Engineering, Woodhead Publishing Limited and Science Press.
4. Swamy and Rao., “Building Planning and drawing”, Chaorator Publications
5. Bhavikatti and Chitawadagi., “Building Planning and drawing”, I.K publications
6. B.C Punmia., “Building construction Technology”, Laxmi Publications

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Subject Code	Subject	L	T	P	C
MA-201	Probability and Statistics	3	1	0	4

A. Course objectives:

The course is designed to meet the objectives of:

- imparting theoretical knowledge and practical application to the students in the area of Stochastic Process,
- introducing the basic notions of probability theory and develops them to the stage where one can begin to use probabilistic ideas in statistical inference and modeling, and the study of stochastic processes,
- providing confidence to students in manipulating and drawing conclusions from data and provide them with a critical framework for evaluating study designs and results,
- injecting future scope and the research directions in the field of stochastic process.

B. Course Content:

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

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

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

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

Estimation: Maximum likelihood estimate of statistical parameters (Binomial, Poisson and Normal distribution). Interval estimation (Normal distribution). Testing of Hypothesis and χ^2 goodness of fit.

Curve fitting: Linear and Nonlinear

C. Text Books

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

D. Reference Books

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

E. Course Outcomes:

Upon Completion of the subjects:

- a) students will add new interactive activities to fill gaps that we have identified by analyzing student log data and by gathering input from other college professors on where students typically have difficulties,
- b) students will add new simulation-style activities to the course in Inference and Probability,
- c) students will be substantially prepared to take up prospective research assignments.

Subject Code	Subject	L	T	P	C
MH 201	Introduction to Human Values and Ethics	3	0	0	3

Objectives:

The course is designed to meet with the objectives of:

1. Enabling students to acquire and cultivate ethical practices in terms of business, engineering and life in general.
2. Developing a sense of moral responsibility in business and enterprise.
3. Emphasizing the importance of values and ethics in modern life.

Course Content:

Universal Human values

Getting to Know Your Students: Aspirations and family expenditures, Purpose of the Course, Gratitude, Competitions and Co-operation: The Full story of Tortoise and Rabbit), Competition and Excellence, Self and Body, Peer Pressure, Self Confidence, Identity and Assumptions, Prosperity, Peer pressure –English, Relationships- Seven Relations, Relationship Vs Transaction, Mulya in Relationships: Trust, Mulya in Relationships: Respect, Anger (if time permits, Nature – Four Orders), NIRMAN: Youth for Purposeful Life, Gandhi Film, Gandhi Film- Points to ponder

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society, Nature of values: Value Spectrum of a good life, Psychological values: Integrated personality; mental health, Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

Aesthetic values:

Perception and enjoyment of beauty, simplicity, clarity, Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

A. Text Books:

1. Being Good: A Short Introduction to Ethics, Simon Blackburn Oxford University Press, 2001
2. The Most Good You Can Do: How Effective Altruism Is Changing Ideas About Living Ethically Peter Singer, Yale University Press 2015

B. Reference Books:

1. Professional Ethics and Human Values 2013 Govindarajan M
2. Professional Ethics and Human Values, S. Dinesh Babu, Firewall Media, 2007
3. A Textbook on Professional Ethics and Human Values, R.S. Naagarazan,

C. Programme Outcomes:

1. Understand the importance of values and ethics in business and work places
2. Understand the benefits of managing ethics at workplace.

Fourth Semester

Detailed Syllabus

Proposed curriculum (Civil Engineering Department -NITAP)

SI No	Course Code	Course Title	L	T	P	C
1	CE-209	Fluid Mechanics - II	2	1	0	3
2	CE-210	Surveying - II	2	1	0	3
3	CE-211	Transportation Engineering - I	2	1	0	3
4	CE-212	Structural Analysis - I	2	1	0	3
5	CE-213	Surveying Laboratory - II	0	0	3	1.5
6	CE-214	Civil Engineering Drawing	0	0	3	1.5
7	CE-215	Structural Engineering Laboratory	0	0	2	1
8	CE-216	Transportation Engineering Laboratory - I	0	0	2	1
9	MH-206	Entrepreneurship	3	0	0	3
Contact Hours			11	4	10	
Total Credits						20

Subject Code	Subject	L	T	P	C
CE-209	Fluid Mechanics - II	2	1	0	3

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

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

Course content:

1. Uniform Flow in Open Channels: velocity distribution, Specific energy, Critical flow, critical depth, normal depth, sequent depth, types of flow, Channel transitions – change in depth and width, Uniform flow equations, design of channels
2. Steady Gradually Varied Flow: Differential equations, Gradually varied flow equation, flow profile classification, Computation of GVF profiles – Direct step method and standard step method.
3. Steady Rapidly Varied Flow: Critical, Sub-critical and Super-critical flow, Hydraulic jump – equation, location of jump, classification of jump, Specific force, Computation of energy loss, flow over sharp and broad crested weir.
4. Unsteady Flow: mass and momentum equations - St. Venant's equations, Waves and their classifications, Celerity of a wave, surge formation – positive and negative surges.
5. Hydraulic Machinery: Classification of hydraulic machines, Design of Pelton turbine, Design of Francis turbine, Design of centrifugal pump, Design of a Kaplan turbine/ axial flow pump, Selection of hydraulic machines.

Books:

1. Chow V.T. Open Channel Hydraulics, Blackburn Press , 2009
2. Franck M White, Fluid Mechanics, Tata Mc Graw Hill Publications 2011.
3. Robert W. Fox Ogukuo H. Orutcgardm Alan T. Mc Donald, Introduction to Fluid Mechanics, Student Edition 7th Wiley India Edition, 2011.
4. Subramnaya, K., Flow In Open Channel, Tata McGraw Hill Publications, New Delhi, 2008.
5. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
6. Mays L. W., "Water Resources Engineering", John Wiley and Sons (WSE), New York, 2005

Subject Code	Subject	L	T	P	C
CE-210	Surveying - II	2	1	0	3

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

1. Should be able to understand the basic of surveying.
2. Should be aware of the role of surveying in the site investigation before carrying out any construction work.
3. Will be able to understand the methods of chain and compass surveying
4. The concepts of levelling and contouring will be clear.
5. Will have the knowledge of various surveying equipments and their uses such as theodolite, compass, plane table etc.

Course content:

1. **Leveling:** Trigonometric leveling, Base of the object accessible, base of an inclined object accessible, R.L of an elevated points with inaccessible bases, Cross-sectioning, profile leveling, Precise Leveling, Reciprocal Leveling
2. **Tachometry:** Instrument used, Methods of Tacheometry, fixed hair method, movable hair method, range finding,
3. **Triangulation:** Principles of triangulation, Classifications, purpose, layout, Field work, Types of triangulation station
4. **Curves:** Types of curves, elements of curve, different methods of setting out- simple circular curves, compound curves, reverse curves, transition curves, types of transition curves, super-elevation, suitability of a circular curve, vertical curves.
5. **Introduction to total station:** Total Station and GPS: Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory -

Proposed curriculum (Civil Engineering Department -NITAP)

electromagnetic distance measuring system - principle of working and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

6. **Introduction to GIS:** Introduction – GIS definition, development, application areas. GIS Applications – Transportation, Water Resources, Environment, Geology, Emergency Management, Agriculture, Urban planning, climate change, Business.
7. **Introduction to remote sensing techniques:** Advantages of Remote Sensing over conventional surveying methods Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Image Processing - Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised. Applications: Geosciences, Water Resources, Land use – Land cover, Transportation Engineering, Image Interpretation

Books:

1. K.R. Arora., “Surveying Volume-I” Standard Publishers Distributors, 2010
2. B.C. Punmia, A. K.. Jain & A.K. Jain, „Surveying Volume-I“ Laxmi Publications 2005
3. R.Agor “Surveying and Levelling”, Khanna Publishers.New Delhi,1996
4. S.K.Duggal “Surveying Volume-I”,Tata McGraw Hill Publisher,New Delhi,2004
5. Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, 2007.
6. James B. Campbell, Randolph H. Wynne. “Introduction to Remote Sensing”, The Guilford Press, 2011.
7. Lillisand T.M and Kiefer R.W “ Remote sensing and image Interpretation”,John Wiley & Sons, 2008
8. Floyd F.Sabins, Remote Sensing: Principles and interpretation, W.H. Freeman and Company, 2007
9. Bhatta, “Remote sensing and GIS”, Oxford Publishers

Subject Code	Subject	L	T	P	C
CE-211	Transportation Engineering - I	2	1	0	3

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

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

Course content:

Proposed curriculum (Civil Engineering Department -NITAP)

1. Introduction to transportation engineering; Classification of roads; Geometric design of highways: cross sectional elements, sight distance and its application, super elevation, horizontal alignment, vertical alignment; Pavement types and components of a pavement structure; Role, design and experimental characterization of different pavement materials including: subgrade soil, aggregates, asphalt, modified asphalt, emulsion, cutback, bituminous mix and cement concrete mix; Analysis of pavement structures and design considerations; Design of flexible pavements, Design of rigid pavements; Introduction to Superpave method of pavement material characterization.
2. **Road development and planning:** Brief history of road development, Road cross section, necessity of transportation planning, classification of roads, road patterns, planning surveys, saturation system, highway planning in India, road development plans.
3. **Highway location and alignment:** Basic requirements of an ideal alignment and factors controlling, engineering survey for highway location, drawing and reports, highway projects.
4. **Highway geometric design:** Highway cross section elements, sight distances, Design of horizontal alignment, Transition curves and vertical alignment.
5. **Traffic engineering:** Traffic characteristics, traffic studies and their uses, traffic flow characteristics, traffic control devices, intersections, traffic planning, Trip generation models, trip distribution models, modal split analysis.
6. **Pavements design:** Design factors, Design of flexible pavements, CBR, GI and Bur mister methods, Design of rigid pavements.
7. **Pavement materials:** Soils, Aggregates and their characteristics, bituminous materials and mixtures, Portland cement concrete.
8. **Construction of roads:** Construction of water bound macadam roads, bituminous pavements, cement concrete pavements, design and construction of joints in cement concrete pavements.

Books:

1. Patha Chakraborty and Animesh Das, Principles of Transportation Engineering
2. Satish Chandra and M.M Agarwal, Railway Engineering
3. S.C. Rangwala, Railway Engineering
4. B.L Gupta and Amit Gupta, Railway Engineering
5. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, Airport Engineering: Planning, Design and Development of 21st Century Airports
6. Rangwala, Airport Engineering, Chorator publishing house ,2013.

Subject Code	Subject	L	T	P	C
CE-212	Structural Analysis - I	2	1	0	3

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

1. Apply the principle of virtual work
2. Determine deflection of a beam for various loading conditions
3. Apply unit load method to find the deflection of truss
4. Determine different stresses developed in thick cylinders

5. Visualize the behavior of column for combined bending and axial loading

Course content:

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

Proposed curriculum (Civil Engineering Department -NITAP)

- 2. Determination of deflection curve of beams-** double integration - Macaulay's method - Area moment method - Conjugate beam method - strain energy and dummy unit load approaches to deflection of Simple and Curved members.
- 3. Statically indeterminate Structures** - Propped cantilever, fixed and continuous beams - Theorem of three moments - Bending moment and shear force diagrams
- 4. Thick cylinders** - Lamé's equation - Shrink fit - compound cylinders.
- 5. Deflection of trusses** - Unit load method - Strain energy method - Williot Mohr's diagram
- 6. Theory of columns:** Axial load- Euler's theory- Rankines formula, combined bending and axial load.
- 7. Three Hinged Arches:** Action of an arch - eddy's theorem - Three hinged, parabolic and segmental arches - determination of horizontal thrust, bending moment, normal thrust and radial shear, Influence lines for three hinged arches.

Books:

1. T.S.Thandavamoorthy, Structural Analysis, Oxford University Press, 2014
2. Devdas Menon, Structural Analysis, Narosa Publishing House,2014
3. S S Bhavikatti, Structural Analysis-I, Vikas Publishing House Pvt Ltd, 2015
4. D S Prakash Rao, Structural Analysis-A Unified Approach –Universities Press, 2012
5. L.S. Negi, Theory and Problems in Structural Analysis, Tata McGraw Hill Pub, 1997.
6. Wang C.K. - Intermediate Structural Analysis – Tata McGraw Hill Publishers, 2010.

Subject Code	Subject	L	T	P	C
CE-213	Surveying Laboratory - II	0	0	3	1.5

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

1. Understand the principle trigonometric levelling.
2. Understand the use of total station.
3. Introduction to GIS.

Course content:

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

Books:

1. K.R. Arora. Surveying Volume-I, Standard Publishers Distributors, 2010
2. B.C. Punmia, A. K. Jain & A.K. Jain, Surveying Volume-I, Laxmi Publications 2005
3. R.Agor, Surveying and Levelling, Khanna Publishers. New Delhi, 1996
4. S.K. Duggal, Surveying Volume-I, Tata McGraw Hill Publisher, New Delhi, 2004
5. Kanetkar and Kulkarni, Surveying and Levelling, Pune Vidyarthi Griha

Subject Code	Subject	L	T	P	C
CE-214	Civil Engineering Drawing	0	0	3	1.5

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

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

Course content:

1. **Classification of buildings** - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio - Orientation of buildings - Lighting and Ventilation
2. **Planning and preparing sketches and working drawings** of Residential buildings and Industrial buildings.
3. **General arrangement drawing of Civil engineering structures-** buildings, bridges, retaining wall, dams, pipelines, water tanks etc. with design notations.

- 4. Plans, elevations and sectional view of Civil engineering structures.**
- 5. Different types of stair case.**
- 6. Typical detailing of beams, columns and foundations.**

Proposed curriculum (Civil Engineering Department -NITAP)

Books:

1. V. B Sikka, Civil Engineering drawing, Kataria Publishing,2009
2. Rangwala, Civil Engineering drawing, Charoatar Publishing House
3. Meo And Mallick, Civil Engineering drawing, Indian publishing house
4. Jolhe., Engineering Drawing, Tata McGraw Hill,
5. Venugopal K and Prabhu Raja V,Engineering Graphics, New age publications.
6. VenuGopal., Engineering Drawing, Graphics and Autocad, Tata Mc graw Hill.

Subject Code	Subject	L	T	P	C
CE-215	Structural Engineering Laboratory	0	0	2	1

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

1. Students will know about the strength of Materials
2. Students will have knowledge about the Stress and strain behavior of different materials

List of Practicals:

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

Books:

1. Arun Jain,,S.Reddy., Basic Structural Analysis, Tata McGraw-Hill Education, New Delhi, 1994.
2. C.K.Wang, Indeterminate Structural Analysis
3. J.B.Willbur, C.H. Norris and Utku, Elementary structural analysis
4. B.G. Neal., Plastic methods of Structural analysis
5. B.C.Punmia, Ashok Jain., Theory of Structures

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-216	Transportation Engineering Laboratory - I	0	0	2	1

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

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

List of Practicals:

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

Books

1. Patha Chakraborty and Animesh Das, Principles of Transportation Engineering
2. Satish Chandra and M.M Agarwal, Railway Engineering
3. S.C. Rangwala, „Railway Engineering
4. B.L Gupta and Amit Gupta, Railway Engineering
5. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, Airport Engineering: Planning, Design and Development of 21st Century Airports
6. Rangwala, Airport Engineering, Chorator publishing house,2013

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
MH 206	Entrepreneuership	3	0	0	3

A. Objectives:

The course is designed to meet the objectives of:

1. To involve themselves in the business activities
2. Starting innovative practices in their entrepreneurial activities.
3. Developing their skills on the traits that they want to carry forward.
4. Starting activities on Forest based Technology.

B. Course Content:

Introduction to Entrepreneurship

Meaning, Role of Entrepreneur, Entrepreneur Process: different approaches, Motivation for becoming an Entrepreneur.SME Concept, its role, status, prospects and policies for promotion of SMEs.Importance of Entrepreneurship: innovations, Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices.

Importance of Entrepreneurship

Entrepreneurship and Innovations, Converting Innovation to Economic Value which includes, Growth Strategies, value position, Market Segments, Value Chain Structure, Revenue Model, Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices.Contribution of Entrepreneurs: Towards R&D, creates Wealth of Nation & Self prospect with Challenge.Entrepreneur Carrier: Different Stages, Entrepreneur Development Programmers (EDPs).

Characteristics of Entrepreneurship

Risk taker, Perceptive, Curious, Imaginative, Persistent, Goal setting, and Hardworking, Research & Management Skill, Organizing& Controlling, Soft skills and Feasibility.Women Entrepreneurship: Opportunities, promotion Hurdles and Prospects of women Entrepreneurs,Factors & Models of Entrepreneurial Development. Social Entrepreneurial Initiative: Solving social problems through opportunity identification, idea generation techniques, Business plan, Strategic Plan etc.

C. Text Books:

1. Desai, Vasant, Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi. 2008

2. Kaulgud, Aruna (2003). Entrepreneurship Management. Vikas Publishing House, Delhi.
3. Cynthia, L. Greene (2004). Entrepreneurship Ideas in Action. Thomson Asia Pvt. Ltd., Singapore.

D. Reference Books:

1. Timmons, Jerry A., and Spinelli, Stephen, 2009. New Venture Creation: Entrepreneurship for the 21st Century, 8th Edition, Boston, MA: Irwin McGraw-Hill
2. Entrepreneurship: Successfully Launching New Ventures by Barringer, Pearson Education Publishing 2015
3. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001
4. [Donald F. Kuratko](#), Entrepreneurship: Theory, Process, Practice Cengage Learning 2017

E. Programme Outcomes:

1. Start their venture more scientifically.
2. Start their venture by linking with the financial institutions.

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Fifth Semester

Detailed syllabus

Proposed curriculum (Civil Engineering Department -NITAP)

V th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-301	Design of RCC Structures - I	3	0	0	3
2	CE-302	Geotechnical Engineering - I	2	1	0	3
3	CE-303	Transportation Engineering - II	3	0	0	3
4	CE-304	Concrete Technology	3	0	0	3
5	CE-305	Water Resources Engineering	2	1	0	3
6	CE-306	Engineering Geology	2	0	0	2
7	CE-307	Geotechnical Engineering Laboratory - I	0	0	2	1
8	CE-308	Concrete Technology Laboratory	0	0	2	1
9	CE-309	Internship - I	0	0	0	1
Contact Hours			15	2	4	
Total Credits						20

Subject Code	Subject	L	T	P	C
CE-301	Design of RCC Structure - I	3	0	0	3

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

1. Design the Reinforced Concrete beams using limit state and working stress methods
2. Design Reinforced Concrete slabs
3. Design the Reinforced Concrete Columns and footings
4. Design structures for serviceability
5. Design stair cases, canopy

Course content:

1. **Introduction-** Review of Concrete making materials- Structural concrete- Grades- properties of Concrete- Modulus of elasticity-flexural strength-Characteristic and Design values-Partial safety factor.
2. **Methods of design-** Aims of design- RCC- Limit State method- Assumptions- Stress-Strain behavior of Steel and Concrete- Stress block parameters- Working stress method-comparison of design process.
3. **Design of Singly Reinforced Beams-** Analysis of Singly Reinforced RC Section- Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections- Moment of Resistance- Design parameters- Design examples.
4. **Design of Doubly Reinforced Beams-** Necessity of Doubly Reinforced sections- Analysis of Doubly Reinforced RC Section-Moment of Resistance- Design parameters- Design.

5. **Shear and Bond design of RCC**- Shear forces in RC-Shear Resistance of RC- Truss analogy- design of Vertical stirrups-Bent-up bars- Limitation- Bond failure in RC- Check for bond resistance-Development length-Design for shear and bond.
6. **Design of Flanged Beams**- Analysis of flanged RC section- Singly and Doubly reinforced- Effective flange width- Moment of Resistance- design examples.
7. **Design of RCC Slabs**- Design of One and Two way slabs- Effect of edge conditions- Moment of resistance-Torsion reinforcement at corners- Design examples.
8. **Design of Continuous Slab and Beams**- Effect of continuity- analysis of continuous beam/slab- Moment and shear coefficients for continuous beam/slab- Critical sections.
9. **Design of RC Columns**- Design principles of RC columns- Assumptions- Rectangular and Circular columns- Helical reinforcement- Minimum eccentricity-Use of Interaction diagrams for Axial load and Moment.
10. **Design of RC Footings**- RC footings-Minimum depth of footing- Safe bearing capacity- Design for Bending-Shear in One way and Shear in Two way- Transfer of load at base of column.
11. **Design for Serviceability**- Concept of Serviceability- Deflection- Span to depth ratio- Short term-Long term deflection due to Shrinkage, Creep- Cracking-Crack width calculation.
12. **Design of Miscellaneous RC Structures**- Design of Stair case – Design of Canopy Slab and Beam

Books:

1. Limit State Design of Reinforced Concrete by P.C. Varghese, Prentice Hall of India, New Delhi
2. Reinforced Concrete by S.K Mallick and A.P. Gupta, Oxford and IBH
3. Reinforced Concrete Design by S.N. Sinha, Tata Mc Graw Hill
4. Reinforced Concrete by A.K. Jain, Nemchand Brothers, Roorkee
5. Limit State Design of Reinforced Concrete Structures – B.C.Punmia, Ashok.K.Jain and Arun.K.Jain, Laxmi Pub. Pvt Ltd, Edition, 2016
6. IS-456-2000, BIS Publication
7. Design of Reinforced Concrete Structures - N. Krishnaraju, CBS Pub, 2016
8. Design of Reinforced Concrete structures – N. Subramanian, Oxford Pub Pvt Ltd, 2013
9. Reinforced Concrete Design - Unnikrishnan & Pillai, McGraw Hill Pub, 2009

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-302	Geotechnical Engineering - I	2	1	0	3

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

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

Course content:

1. Introduction: Soil formation- Development of soil mechanics- Importance of soil engineering- Major soil deposits of India.
2. Basic Definitions and Relationships: 3-phase soil system, Volumetric relationships and weight -volume relationships
3. Determination of Index Properties: Water content, Specific gravity, Grain size distribution by sieve and hydrometer analysis, Relative density, Atterberg limits and indices.
4. Classification of Soils: Classification of soil systems – Particle size classification, Textural classification, AASHTO classification, Unified soil classification and Indian soil classification- Field identification of soils, Relative suitability of soils for engineering works based on soil classification.
5. Soil Water: Types of soil water, Capillarity in soils, Permeability of soils, Darcy’s law, Determination of permeability of soils, Permeability of stratified soils, Field permeability determination, Seepage velocity, Absolute coefficient of permeability, Factors affecting permeability- Effective stress principle- Effective stress under different field conditions- Seepage pressure-Quick sand condition.
6. Compaction of Soils: Definition and importance of compaction – Standard Proctor compaction test, Modified compaction test- Factors affecting compaction- Influence of compaction on soil properties – Field compaction and its control, Relative compaction.
7. Stress distribution in Soils: Importance of estimation of stresses in soils – Boussinesq’s and Westergaard’s theories for point loads, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal planes – Newmark’s influence chart, Contact pressure distribution in sands and clays.
8. Consolidation: Types of compressibility – Immediate settlement – Primary consolidation and secondary consolidation – Stress history of clay, Normally consolidated soil, Over consolidated soil and under consolidated soil- preconsolidation pressure and its

determination- Consolidation test, Estimation of settlements -Terzaghi's 1-D consolidation theory – Coefficient of consolidation and its determination - Spring analogy.

9. Shear Strength: Definition and use of shear strength - Source of shear strength- Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory-Measurement of shear strength, Drainage conditions -Direct shear test, Triaxial shear test.

Books:

1. Ranjan and Rao., Basic and Applied Soil Mechanics, Wiley Eastern Ltd., New Delhi, 2016.
2. V.N.S. Murthy, Soil Mechanics and Foundation Engg, CBS Pub. New Delhi. 2007.
3. David F. McCarthy, Essentials of Soil Mechanics and Foundations-Basic Geotechnics”, Pearson Pub., New Delhi. 2015
4. Narsinga Rao, Soil Mechanics and Foundation Engineering, Wiley India Pvt. Ltd. New Delhi. 2015
5. Debashis Moitra, Geotechnical Engineering, University Press (India) Pvt. Ltd. Hyderabad.2016
6. Criag., Soil Mechanics - CRC Press - 2012

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-303	Transportation Engineering - II	3	0	0	3

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

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

Course Content:

1. Introduction, Permanent Way and Components: History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation,– functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, Timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications.
2. Track Geometrics, Turnouts and Crossings, Stations and Yards: Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings. Different types of stations and Yards: classification and functioning.
3. Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas.
4. Introduction to Airport Engineering Air craft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment.
5. Water Transport Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Inland waterways: advantages and disadvantages; Development in India, Inland water operation.

Books:

1. Patha Chakraborty and Animesh Das, Principles of Transportation Engineering.
2. Satish Chandra and M.M Agarwal, Railway Engineering.
3. S.C. Rangwala, Railway Engineering.

Proposed curriculum (Civil Engineering Department -NITAP)

4. B.L Gupta and Amit Gupta, Railway Engineering
5. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, Airport Engineering: Planning, Design and Development of 21st Century Airports”
6. Rangwala, Airport Engineering, Chorator publishing house,2013
7. Khanna and Justo,High way engineering,Publisher, Nem Chand & Bros

Subject Code	Subject	L	T	P	C
CE-304	Concrete Technology	3	0	0	3

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

1. Identify Quality Control tests on concrete making materials
2. Understand the behavior of fresh and hardened concrete
3. Design concrete mixes as per IS codes
4. Understand the durability requirements of concrete
5. Understand the need for special concretes

Course content:

1. **Concrete Making Materials:** Cement, Fine Aggregate, Coarse aggregate, Water, Chemical & Mineral admixtures.
2. **Hydration of Cement:** Bogue’s compounds, Hydration, Gel formation, Types of cement, pore & capillary water.
3. **Quality tests on cement:** Different test on cement as per Indian standards
4. **Aggregates:** Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis – Grading.
5. **Fresh concrete:** Properties of fresh concrete- Workability – different tests of workability Factors influencing workability compaction, finishing, curing.
6. **Hardened concrete:** Tests on hardened concrete as per IS codes – Relationship between different strengths – factors influencing strength, NDT techniques.
7. **Durability:** Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack.
8. **Concrete Mix design:** Different methods of mix design – factors affecting mix design – exercises.
9. **Admixtures** - accelerating admixtures - Retarding admixtures - water reducing admixtures - Air entraining admixtures - coloring agent - Plasticizers. Batching - Mixing -Transportation - Placing of concrete - curing of Concrete

10. Strength of Concrete - Shrinkage and temperature effects - creep of concrete - permeability of concrete - durability of concrete - Corrosion - Causes and effects - remedial measures- Thermal properties of concrete - Micro cracking of concrete.

11. Special Concrete - light weight concrete - Fibre reinforced concrete - Polymer-polymer modified concrete - Ferrocement - Mass concrete - Ready mix concrete- Self compacting concrete- Quality control - Sampling and testing-Acceptance criteria

Books:

1. Properties of Concrete, AM Nevelli – 5 th Ed, Prentice Hall Publishers, 2012.
2. Concrete Technology, M. S. Shetty – S Chand Co., Publishers, 2006.
3. Concrete Technology, M. L. Gambhir – Tata Mc Graw Hill Publishers, 2012.
4. Testing of Concrete in Structures, J.H. Bungey , Surrey Univ Press, New York

Subject Code	Subject	L	T	P	C
CE-305	Water Resources Engineering	2	1	0	3

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

1. Understand the hydrological parameters
2. Analyze the rain fall data and estimate the abstraction
3. Arrive the rainfall-runoff models
4. Solve the flood routing problems
5. Understand the groundwater occurrence and movement.

Course content:

1. Introduction to Hydrologic cycle, water budget equation, basic concepts of weather systems, characteristics of precipitation in India
2. Precipitation: Weather system for precipitation, Characteristics of precipitation, Rain Gauge Network, Test for consistency of data, analysis of rainfall data, intensity-duration-frequency analysis, Depth-Area-duration relationship,
3. Evaporation and Evaporation Process, measurement, estimation and control of evaporation, Evapotranspiration, measurement and estimation of evapotranspiration, interception and depression storage, Infiltration process, measurement of infiltration, infiltration models and infiltration indices and effective rainfall
4. Stream flow measurement: measurement of stage, measurement of velocity, area-velocity method, Stage-discharge relationship, extrapolation of rating
5. Runoff: Runoff characteristics of streams, flow-duration curve, flow-mass curve, runoff computation.

Proposed curriculum (Civil Engineering Department -NITAP)

6. Hydrograph: Factors affecting flood hydrograph, Components of a hydrograph, Base Flow separation, effective rainfall, unit hydrograph, derivation of unit hydrograph, unit hydrograph of different durations, use and limitations of different hydrograph, Distribution graph, synthetic unit hydrograph
7. Floods: Estimation of peak discharge, rational method, SCS method and unit hydrograph method, Design flood, return period, flood frequency analysis, probabilistic and statistical concepts. Gumbel's and log Pearson Type III methods.
8. Flood routing: Basic Equations, hydrologic storage routing, attenuations, hydrologic channel routing, hydraulic method of flood routing, flood control
9. Groundwater: Occurrence of groundwater, types of aquifers, aquifer properties, Groundwater movement, Darcy's law, Conductivity and Transmissivity, yield from a well under steady state conditions, Pumping tests, unsteady flow in unconfined aquifers, well losses and specific capacity

Books:

1. Subrahmanya, K., 2008, Engineering Hydrology, Tata Mc Graw Hill Pub. Co., New Delhi.
2. Chow, V. T., Maidment and Mays, L. A., 2010, Applied Hydrology, Tata Mc Graw Hill Pub. Co., New York
3. Viesmann W and Lewis G Lt (2008) "Introduction to Hydrology". Prentice Hall of India
4. Ojha CSP, R. Berndtsson and P Bhunya (2008), Engineering Hydrology, Oxford University Press Co., New Delhi.

Subject Code	Subject	L	T	P	C
CE-306	Engineering Geology	3	0	0	3

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

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

Course content:

1. **General Geology:** Branches and scope of geology, Earth, its position in the solar systems, surface features and internal structure, work of natural agencies like lakes, oceans, atmosphere, wind, streams, sea, glacier, Earth movements. Types of weathering, mountains

and mountain building.

2. **Mineralogy:** Definition of crystal and a mineral, the study of the physical properties and occurrence of quartz, Feldspar, Mica, kyanite, calcite, talc, corundum, gypsum, fluorite, biotite, muscovite, graphite, realgar, magnetite, limonite, pyrite, galena, barite, dolomite, garnet, tourmaline, chalcopyrite, opal, topaz, hornblende, kaolinite, diamond.
3. **Petrology:** Formation and classification of rocks into three types, Igneous, sedimentary and metamorphic rocks, description of physical properties for constructional purposes of granite, pegmatite, dolerite, gabbro, basalt, sandstone, conglomerate, breccias, limestone, shale, schist, marble, quartzite, khondalite, slate, gneiss, andesite, stratigraphy of India (a general idea), principles of correlation, fossils, their preservation and significance
4. **Structural geology:** Strike and dip, outcrops, volcanoes, overlaps, inliers and outliers, types classification of folds, faults, joints, unconformities
5. **Engineering Geology:** Ground water, zones of ground water, water table and perched water table, water bearing properties of rocks, occurrence of ground water, springs, selection of a site for well sinking and ground water investigations.
6. **Earthquakes and landslides:** Classification, causes and effects of earthquakes and landslides, seismic curve, seismographs, seismograms, accelograms, seismic problems of India, seismic zones of India, remedial measures to prevent damage for engineering structures, case histories.
7. **Geological investigation:** Interpretation of geological maps, use of aerial maps in geological surveying, geophysical methods as applied to civil engineering for subsurface analysis (Electrical and Seismic methods).
8. **Geology of dams and reservoirs:** Types of dams, requirements of dam site, preliminary and detailed geological investigations for a dam site, important international and Indian examples of failures of dams and their causes, factors affecting the seepage and leakage of the reservoirs and the remedial measures, silting of reservoirs.
9. **Rock mechanics and tunneling:** Purposes of tunneling and geological problems connected with tunneling, geological considerations in road alignment, roads in complicated regions, problems after road construction, geology of bridge sites

Books:

1. Parbin Singh, Engineering and General Geology, S.K. Kataria and Sons, New Delhi.
2. P.K. Mukherjee, A text Book of Geology, the world Press Private Limited, Calcutta.
3. S.K. Garg, Physical and Engineering Geology, Khanna Publishers, Delhi..
4. E.S. Dana, Mineralogy, Wiley Eastern Ltd., New York, John Wiley & sons, 1935
5. M.S. Krishnan, Geology of India and Burma, CBS publishers and
6. distributors, Delhi, 2009
7. N. Chenna Kasavulu, Engineering Geology, Macmillan, New Delhi

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-307	Geotechnical Engineering Laboratory - I	0	0	2	1

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

1. Students will have idea about stress and strain of soil
2. Students will have knowledge of permeability of soil

List of Practicals:

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

Books:

1. B.M Das., Fundamentals of Geotechnical Engineering, ,Cengage learning,2010
2. Ranjan and Rao., Basic and applied soil Mechanics, New age international,2000
3. B.C. Punmia and Jain., Soil mechanics and foundations, firewall media,2005

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-308	Concrete Technology Laboratory	0	0	2	1

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

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

List of Practicals:

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

Books:

1. Properties of Concrete, AM Nevelli – 5th Ed, Prentice Hall Publishers, 2012.
2. Concrete Technology, M. S. Shetty – S Chand Co., Publishers, 2006.
3. Concrete Technology, M. L. Gambhir – Tata Mc Graw Hill Publishers, 2012.

Sixth Semester

Detailed syllabus

Proposed curriculum (Civil Engineering Department -NITAP)

VI th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-310	Design of RCC Structures - II	3	0	0	3
2	CE-311	Geotechnical Engineering - II	2	1	0	3
3	CE-312	Structural Analysis - II	3	0	0	3
4	CE-313	Environmental Engineering - I	3	0	0	3
5	CE-314	Design of Steel Structures - I	2	1	0	3
6	CE-315	Irrigation and Hydraulic Structures	3	0	0	3
7	CE-316	Environmental Engineering Laboratory - I	0	0	2	1
8	CE-317	Geotechnical Engineering Laboratory - II	0	0	2	1
9	CE-318	Internship - II	0	0	1	1
Contact Hours			16	2	5	
Total Credits						21

Subject Code	Subject	L	T	P	C
CE-310	Design of RCC Structures - II	3	0	0	3

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

1. Design cantilever and counterfort retaining walls.
2. Design underground and elevated water tanks.
3. Design bunkers and silos.
4. Design reinforced concrete chimneys.

Course Content:

1. Detailed design of Cantilever and Counterfort type retaining walls.
2. Wind and Earthquake resistant design of buildings.
3. Design principles of underground and elevated water tanks.
4. Detailed design of rectangular and circular elevated water tanks as per IS 3370, Design of Ring Beam and staging for elevated water tanks: Intz Tanks etc.
5. Introduction to Bridge design.

Books:

1. N. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers and Distributors, 2007.
2. Punmia B.C. Ashok Kumar Jain and Arun K. Jain, RCC Designs(Reinforced Concrete Design), 10th Edition, Lakshmi Publishers, 2006

Proposed curriculum (Civil Engineering Department -NITAP)

3. Limit State Design of Reinforced Concrete by P.C. Varghese, Prentice Hall of India, New Delhi
4. Reinforced Concrete by S.K Mallick and A.P. Gupta, Oxford and IBH
5. Reinforced Concrete Design by S.N. Sinha, Tata Mc Graw Hill
6. Reinforced Concrete by A.K. Jain, Nemchand Brothers, Roorkee
7. Limit State Design of Reinforced Concrete Structures – B.C.Punmia, Ashok.K.Jain and Arun.K.Jain, Laxmi Pub. Pvt Ltd, Edition, 2016
8. IS-456-2000, BIS Publication
9. Design of Reinforced Concrete structures – N. Subramanian, Oxford Pub Pvt Ltd, 2013
10. Reinforced Concrete Design - Unnikrishnan & Pillai, McGraw Hill Pub, 2009

Subject Code	Subject	L	T	P	C
CE-311	Geotechnical Engineering - II	2	1	0	3

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

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

Course Content:

1. **Subsurface Investigation:** Purpose of site investigation ,Borings method, Auger Boring, Wash boring Percussion boring, Area ratio, Soil report, Soil profiling
2. **Earth Pressure:** Types of Earth pressure. Rankine's Active and passive earth pressure, Smooth Vertical wall with horizontal backfill. Extension to Soil, Coulombs wedge theory, Culman's and Rebhann's graphical method for active earth pressure. Bulkheads Classifications, Cantilever sheet Piles
3. **Slope Stability:** Infinite slope, finite slope-form of slip surfaces, Limiting equilibrium method, C- ϕ analysis, Method of slices, location of most critical circle, stability of earth dam slope, friction circle method, Taylor's stability number, Bishop's method of stability analysis, use of stability coefficients, effect of earthquake forces
4. **Bearing Capacity:** Safe bearing capacity and allowable bearing pressure, Terzaghi's bearing capacity equations, its modifications for square, rectangular and circular foundation, General and local shear failure conditions, Factors affecting bearing capacity of Soil. Allowable bearing pressure based on values, Bearing capacity from plate load tests.
5. **Shallow Foundations:** Factors effecting locations of foundation and design considerations of shallow Foundations, Choice of type of foundations, Foundations on expansive soils. Settlement analysis: causes of settlement, Computation of settlement, allowable settlement. Measures to reduce settlement

- 6. Pile Foundations:** Types, Construction, load carrying capacity of single pile Dynamic Formula, Static formula, Pile load tests, Load carrying capacity of pile groups, settlement of pile groups, Negative skin friction.

Books:

1. B.M Das., Fundamentals of Geotechnical Engineering, Cengage learning,2010
2. Ranjan and Rao., Basic and applied soil mechanics, new age international,2000
3. B.C. Punmia and Jain., Soil mechanics and foundations, firewall media,2005

Subject Code	Subject	L	T	P	C
CE-312	Structural Analysis - II	3	0	0	3

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

1. Use various classical methods for analysis of indeterminate structures
2. Determine the effect of support settlements for indeterminate structures
3. Apply the concepts of ILD and moving loads on determinate structures
4. Apply the concept of equivalent UDL
5. Determine the reversal of stresses in trusses using ILD

Course Content:

1. Indeterminate beams - Propped cantilever, Fixed and Continuous beams - Analysis for shear force and bending moment - Clapeyron's theorem of three moments - Slope and deflection - effect of sinking of supports.
2. Slope - Deflection Method: Analysis and application to continuous beams - portal frames (single bay - Single storey).
Moment-Distribution Method: Analysis of continuous beams and portal frames (single storey - single bay).
3. Kani's method - Application to continuous beams and portal frames , Approximate methods of analysis - Portal method - Cantilever method - Substitute frame method
4. Moving Loads: Maximum bending moment and shear force diagrams for simply supported spans traversed by single point load - two concentrated loads - Uniformly distributed load, shorter and longer than the span - enveloping parabola and equivalent uniformly distributed load, determination of maximum bending moment and shear force for a system of concentrated loads on simply supported girders - focal length of a girder - counter bracing.
5. Influence Lines: Influence lines for reaction bending moment and shear force diagrams for simply supported beams - stresses in members of statically determinate pin jointed plane frames due to moving loads.

Proposed curriculum (Civil Engineering Department -NITAP)

6. Two Hinged Arches: Determinations of horizontal thrust, bending moment, normal thrust and radial shear for parabolic and segmental shapes, Influence lines for two hinged arches - effect of rib shortening - temperature effects - tied arches.
7. Suspension Bridges: Force in loaded cable and hanging cables - length of cables for different support conditions - simple suspension bridges with three hinged and two hinged stiffening girders - bending moments and shear force diagrams, influence lines - temperature effects on cables and stiffening girders

Books:

1. T.S.Thandavamoorthy, Structural Analysis, Oxford University Press, 2014
2. Devdas Menon, Structural Analysis, Narosa Publishing House,2014
3. S S Bhavikatti, Structural Analysis-I, Vikas Publishing House Pvt Ltd, 2015
4. D S Prakash Rao, Structural Analysis-A Unified Approach –Universities Press, 2012
5. R L Jindal, Indeterminate Structures, S. Chand & Co., N.Delhi,
6. Wang C.K. - Intermediate Structural Analysis.
7. Reddy C.S. - Basic structural Analysis - Tata Mc Graw - Hill Publishing Company Ltd.
8. Rajasekaran & Sankara Subramanian, Computational Structural Mechanics, PHI, 2003

Subject Code	Subject	L	T	P	C
CE-313	Environmental Engineering - I	3	0	0	3

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

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

Course content:

1. **Water environment:**
Environment, water resources of hydrosphere, different water pollutants and their impacts on human being, Population Forecasting and Water Demand sources of supply, yield, design of intakes, estimation of demand, design period.
2. **Water and waste water characteristics:**
Water quality criteria and standards for potable and industrial uses, control of water borne diseases, Physical, chemical and biological characteristics of domestic and industrial waste waters, significance of pollutant parameters and effluent discharge standards.
3. **Treatment objective and methods:** Unit operations and processes and selection of treatment mode and sequence.

Primary treatment: screening, neutralization, equalization, flocculation, sedimentation, floatation, stripping.

Tertiary treatment: Oxidation/reduction, precipitation, adsorption, ion exchange and membrane (R) O/UF) Processes, disinfection.

4. Conveyance and distribution systems:

Conductors: different pipe systems, design considerations, laying, testing and effects of pipe corrosion and its preventive measures.

Sewers: hydraulic design, construction and appurtenances, operation and maintenance.

Pumps and pumping: necessity, types of pumps, characteristics curves, selection criteria, economical diameter of pumping/transmission main, problems in sewage pumping.

Distribution network: methods, layout, storage, and distribution reservoir, analysis of distribution systems.

5. Plumbing systems:

General principles, materials for service pipe, service connection, water meters, and valves, Principles of house drainage, pipes, traps, sanitary fittings, systems of plumbing, house drainage plans.

6. Rural and Semi urban sanitation:

Collection and disposal of dry refuse, sullage, excretal waste, night soil disposal without water carriage, latrines, chemical toilets, precast units for low cost sanitation.

Books:

1. B.C. Punmia ,,Environmental Engg. (Vol. I), Laxmi Publications.
2. S.K. Garg, Water Supply Engg. (Vol. I), Khanna Publications, 2003.
3. Peavy & Raow., Environmental Engineering, McGraw Hill Publications.

Subject Code	Subject	L	T	P	C
CE-314	Design of Steel Structures - I	2	1	0	3

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

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

Course Content:

1. Introduction: General- Types of Steel – Mechanical behaviour of steel – Measures of Yielding – Measures of Ductility – Types of Structures – Structural Steel Sections.
2. Methods of Structural design: Introduction-Design Philosophies-Working Stress method- Ultimate Strength method-Load and Resistant factor- Limit State Method-Partial safety factor-Load-Load combinations-Classification of Cross sections- General aspects in the design.
3. Design of compression member, tension members, simple beams, columns and base plates using working stress method.
4. Design of Steel fasteners: Types of fasteners – Riveted connections- Bolted connections- Assumptions- Failure of bolted joints – Strength of bolted joints – Design examples – Design of Welded connections – Butt weld- fillet weld – Design examples.
5. Design of Tension Members: General – Modes of Failure of Tension member- Analysis of Tension members- Example - Design steps – Design examples – Lug angles – Design.
6. Design of Compression Members: General – Strength of Compression members- Design Compressive strength- Example on analysis of Compression members – Design of Angle struts – Design Examples- Built up Columns- Design of Lacing – Design of Battens- Design Examples- Design of Roof members.
7. Design of Beams: General- Lateral Stability of Beams- Bending Strength of Beams – Plastic Section Modulus - Design Examples.
8. Design of Beam Columns: Behaviour of members under combined loading – Modes of Failures – Design Examples.
9. Design of Column Splices and Column Base: Design of Column Splice-Design Examples- Design of Column Base- Slab Base- Gusseted Base- Design Examples.
10. Design of Eccentric Connections: Design of Brackets- Type-1 and Type 2 – Moment Resistant connections - Design Examples.

Books:

1. Limit State Design of Steel Structures – S.K.Duggal, TMH Education Pvt Ltd, 2nd Edition, 2014
2. IS-800-2007, BIS Publication
3. Steel Structures : Design and Practice- N.Subramanian, Oxford Pub, 2011
4. Design of Steel structures – S.S. Bhavikatti, IK International Pub Pvt Ltd, 4th Edition

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-315	Irrigation and Hydraulic Structures	3	0	0	3

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

1. Classify various irrigation methods
2. Design irrigation canals
3. Plan and design diversion headwork
4. Understand the seepage theories
5. Design gravity dam
6. Design spillway and energy dissipation structures

Course content:

1. Water requirement of crops: Crop period or base period, delta of a crop, delta on a field, relation between duty and delta, food and nonfood crops, kharif and rabi crops, gross command area, cultivable command area, intensity of irrigation, net and gross sown areas
2. Irrigation Methods: Types of irrigation, methods of applying water to the crops, surface, subsurface irrigation, sprinkler irrigation, uncontrolled or wild floods, free flooding, Furrow irrigation, water logging, salinity
3. Canals: classification, most economical sections, Design of non-scouring channels, channel or channel losses, advantages of lining, Design of stable channels, Silt theories
4. Surface and subsurface flow analysis in hydraulic structures: Hydraulic structures on permeable foundation, Seepage theories, Principles of design of hydraulic structures on permeable foundation
5. Cross drainage works: Introduction, Types of cross drainage works-Aqueduct, siphon aqueduct, superpassage, canal-syphon or siphon, level crossing ,inlets and outlets, selection of cross-drainage works
6. Canal falls: Location of falls, types of falls, classification of falls, Design of straight glacis fall, design of sarda type fall
7. Canal regulations and outlets: Canal escapes types of canal escapes, canal regulator, distributor head regulator, Types of outlets, performance of modules, types of non-modular outlets-open sluice and submerged pipe outlet, rigid modules
8. Gravity Dams: Types of storage head works , Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam
9. River training works: Introduction, different methods
10. Spillway: Introduction, types, design of spill way, energy dissipation structures

Proposed curriculum (Civil Engineering Department -NITAP)

Books:

1. Modi, P. M., 2000, Irrigation Water Resources and Hydropower Engineering, Standard Book Publishing Company, New Delhi.
2. Arora, K. L., 1996, Irrigation Water Resources Engineering, Standard Book Publishing Company, New Delhi.
3. Asawa, G. L., 1996, Irrigation Engineering, New Age International Publishing Company, New Delhi.
4. Murthy, C. S. N., 2002, Water Resources Engineering – Principles and Practice, New Age International Publishing Company, New Delhi

Subject Code	Subject	L	T	P	C
CE-316	Environmental Engineering Laboratory - I	0	0	2	1

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

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

List of Practicals:

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

Books:

1. Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.
2. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002.
3. Kotaiah, B., and Kumara Swamy, N., Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007.

Subject Code	Subject	L	T	P	C
CE-317	Geotechnical Engineering Laboratory - II	0	0	2	1

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

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

List of practical:

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

Books:

1. B.M Das, Fundamentals of Geotechnical Engineering, Cengage learning,2010
2. Ranjan and Rao, Basic and applied soil mechanics, new age international,2000
3. B.C. Punmia and Jain, Soil mechanics and foundations, firewall media,2005

Seventh Semester

Detailed Syllabus

Proposed curriculum (Civil Engineering Department -NITAP)

VII th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-XXX	Open Elective - Engineering Hazard Analysis and Control	3	0	0	3
2	CE-401	Construction Planning and Management	3	0	0	3
3	CE-402	Design of Steel Structures - II	3	0	0	3
4	CE-403	Environmental Engineering - II	3	0	0	3
5	CE-404	Estimation, Contract and Valuation	0	0	0	3
6	CE-405	Elective - I	3	0	0	3
7	CE-406	Internship - III	0	0	0	1
Contact Hours			15	0	0	
Total Credits						19

Subject Code	Subject	L	T	P	C
CE-XXX	Engineering hazard analysis and control (Open Elective)	3	0	0	3

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

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

Course content:

1. **Hazardous Waste Management:** Definition and identification of hazardous wastes-sources and characteristics; hazardous wastes in Municipal Waste: Hazardous waste regulations, minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste-collection and transport, ewaste - sources, collection, and treatment and reuse management. Hazardous waste treatment and Design: Hazardous waste treatment technologies;
2. **Landslide mitigation technology:** Mechanics of landslide and prevention techniques, soil nailing, introduction of geo-synthetics etc.
3. **Flood routing works:** river training works and mechanics behind river erosion, flood control.
4. **Effects of Earthquake and its control-** Basic principles of earth quake resistant design of structures, Repair and retrofitting principles of earth quake damaged structures, concept of base isolation.

Books:

1. Fitts R Charles, Groundwater Science., Elsevier, Academic Press, 2002.
2. B.C. Punmia and Jain „Soil mechanics and foundations, firewall media,2005
3. B.C. Punmia., Environmental Engg. (Vol. I) Laxmi Publications.
4. Pankaj Agarwal and Manish Shrikhande, Earthquake resistant design of structures, PHI 2006.

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-401	Construction Planning and Management	3	0	0	3

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

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

Course Content:

1. Construction project formulation

Introduction-Principles of Management – different types of construction projects –Project Life Cycle- phases in project life cycle- Pre-feasibility report and clearance- project estimate – Techno Economic feasibility report- detailed project report.

2. Construction planning and scheduling

Introduction – work breakdown structure- plan development process- scheduling- definition –types of construction schedules-scheduling techniques-CPM – Terms and definitions –Earliest and Latest times – different types of floats – significance- calculation of critical path method-PERT – terms and definitions network and solving problems using PERT – standard deviation and probability calculation in PERT.

3. Resource planning allocation and control

Materials: Quantity of materials – time of purchase- inventory control – terms and definitions – types of inventory –EOQ –reasons for maintain inventory – different tools for inventory.

Equipment: Classification of major construction equipment- planning and selecting of equipment- task consideration – cost consideration.

Labour: Classes of labour – cost of labour- labour schedule – optimum use of labour. Introduction- resource allocation-resource leveling-resource loading graph – cost control – earned value concepts- “S” curve technique in cost control – Risk cost management- stages in risk management- controlling the risk.

4. Optimisation techniques

Introduction to optimization- Linear programming – formulation of LP problems- solving LP problem using graphical method-Transportation problems-Assignment problems – replacement model (Value of money does not change with time) –Time cost trade off – crashing- computer application in construction management

Books:

1. Chitkara.K.K, Construction Project Management: planning, Scheduling and control, Tata McGraw Hill Publishing Company, New Delhi, 1998.

Proposed curriculum (Civil Engineering Department -NITAP)

- Joy.P.K, Total Project Management –The Indian context, Macmillan India Ltd, New Delhi,1992
- Vohra.N.D., Quantitative Techniques in Management, Tata Mcgraw Hill Publishing Company, New Delhi, 1998.

Subject Code	Subject	L	T	P	C
CE-402	Design of Steel Structures - II	3	0	0	3

Course outcomes: At the end of the course, student will be able o:

- Design Plate Girder
- Design Gantry Girder
- Design Industrial Buildings

Course contents:

- Design of Plate Girder: General- Components of Plate Girder- Optimum depth – Bending Strength – Shear Strength – Shear Buckling- Simple Post critical method- Tension Field method- Stiffeners-Bearing- Transverse stiffeners - Design Examples.
- Design of Gantry Girder: Common shapes of Gantry Girders and its supports-design loads-design basis of gantry girders - Design Examples.
- Industrial Buildings- Introduction-Design loads-Roof trusses-Bracings in buildings-Design examples

Books:

- Limit State Design of Steel Structures – S.K.Duggal, TMH Education Pvt Ltd, 2nd Edition, 2014
- IS-800-2007, BIS Publication
- Steel Structures : Design and Practice- N.Subramanian, Oxford Pub, 2011
- Design of Steel structures – S.S. Bhavikatti, IK International Pub Pvt Ltd, 4th Edition

Proposed curriculum (Civil Engineering Department -NITAP)

Subject Code	Subject	L	T	P	C
CE-403	Environmental Engineering - II	3	0	0	3

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

1. Have knowledge about the environmental impact assessment (EIA).
2. Ability to know the control standards of air and noise pollution.
3. To aware about the role of ecology in environment.

Course Content:

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

Books:

1. Gilbert M Masters „Introduction to Environmental Engineering and Science“ Prentice

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Hall, 2007.

2. J. G. Henry and G. W Heinke, Environmental Science and Engineering“ Prentice Hall, 1989.
3. M.L. Davis and D.A. Cornwell, Introduction to Environmental Engineering“ McGraw-Hill Education, 2012.
4. CPHEEO (Ministry of Urban Development), “Manual on Municipal SolidWaste Management

Subject Code	Subject	L	T	P	C
CE-404	Estimation, Contract and Valuation	3	0	0	3

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

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

Course Content:

1. Preparation of detailed estimates - Preparation of specifications report accompanying the estimate
Approximate methods of Costing - types of estimate - costing for various structures –
2. Rate analysis - rate for material and labour - schedule of rates -data sheets - abstract estimate.
Values and its kinds –
3. Valuation - purpose- scope - methods - land and building method - Factors affecting the value of plot and building - depreciation - Valuation of residential building with case study.
4. Contracts- introduction to Civil engineering contracts documents-PWD, CPWD etc.
5. Preparation of Tender documents for Civil engineering works.

Books:

1. Dutta. B.N, Estimating and Costing in Civil Engineering: Theory and Practice including specifications and valuation, UBS Publishers and distributors, 27th revised edition.
2. Chakraborti. M, Estimating, Costing, Specification & Valuation in Civil Engineering, UBS Publishers and distributors, 2015.
3. Bhasin, P.L., Quantity Surveying, 2nd Edition, S.Chand & Co., 2000. Department of Civil Engineering, National Institute of Technology: Tiruchirappalli – 620 015 91
4. Delhi Schedule of Rates 2018-CPWD Publications
5. Delhi Analysis of Rates 2018- CPWD Publications

Proposed curriculum (Civil Engineering Department -NITAP)

VIII th Semester						
Sl No	Course Code	Course Title	L	T	P	C
1	CE-403X	Elective - II (NPTEL/SWAYAM/MOOC)	3	0	0	3
2	CE-404X	Elective - III (NPTEL/SWAYAM/MOOC)	3	0	0	3
3	CE-498	Project and Dissertation	0	0	20	10
4	CE-499	Grand Viva	0	0	0	2
Contact Hours			6	0	16	
Total Credits						18

Details of Elective-I

Sl. No.	Course Code	Course title	L	T	P	C
1	CE 405A	Foundation Engineering	3	0	0	3
2	CE 405B	Traffic Engineering	3	0	0	3
3	CE 405C	Environmental Impact Assessment and Modelling	3	0	0	3
4	CE 405D	Advanced Structural Analysis	3	0	0	3
5	CE 405E	Municipal Solid Waste Management	3	0	0	3
6	CE 405F	Ground water Engineering	3	0	0	3
7	CE 405G	Earthquake Resistant Design	3	0	0	3
8	CE 405H	Theory of Plate and Shell	3	0	0	3
9	CE 405J	Remote Sensing and GIS				

Subject Code	Subject	L	T	P	C
CE-405A	Foundation Engineering	3	0	0	3

Course Outcome:

1. Understanding the basics of foundation Engineering.
2. To be efficient in designing the foundations.
3. To realize the importance of foundation in the construction works.
4. A strong background in Foundation engineering.
5. Strong in Designing the foundation and able to analyse the load on the foundation from the superstructures.
6. Understand the importance of machine foundation and well foundation.

Course Content:

Foundations:

Different types of loads on foundations, types of shallow and deep foundations, footing-rafts-piles-wells-selection of foundation type-dewatering of foundations-type of explorations, methods of boring, soil samples and samples.

Shallow foundations:

Proposed curriculum (Civil Engineering Department -NITAP)

Definition, bearing capacity, factors affecting bearing capacity, Terzaghi's theory of bearing capacity, effect of foundation size and shape, Effect of ground water table, determination of bearing capacity from building codes, plate load test, penetration test, static and dynamic cone tests, Housel's approach, bearing capacity of sands and clays, settlements of foundation. Elastic settlements, consolidation settlements, differential settlements, permissible settlements, design principles of depth of foundation, spread footing, combined footing, raft foundations, principles of floating frats, foundations on non-uniform soils.

Deep foundation:

Types of piles based on function, materials and methods of construction, friction and end bearing piles, static formulae-Engineering News and Hiley's formula, group action in piles, block failures, settlement of pile groups in sands and clays pile load test negative skin friction, under reamed piles.

Well foundation:

Elements, forces acting on well, lateral stability analysis, problems in sinking of wells and remedial measures.

Machine foundations:

Model study, natural frequency of block foundation system, block foundation under vertical vibration.

Books

1. P. C. Varghese 'Foundation engineering' phi learning pvt. Ltd, 2005
2. Braja M. Das 'Principles of foundation engineering' Cengage learning, 2010.
3. S. Hansbo 'Foundation Engineering' newness, 1994.
4. P. Purushothama Raj 'Soil mechanics & foundation engineering' Pearson education India, 2008

Subject Code	Subject	L	T	P	C
CE-405B	Traffic Engineering	3	0	0	3

Course Outcomes:

1. To appreciate the traffic engineering as application of engineering techniques to achieve the safe and efficient movement of people and goods.
2. To understand the relationship between different parts of traffic engineering
3. To design the cross-section and alignment of highway
4. To use an appropriate traffic flow theory for traffic characteristics
5. To practice the traffic count methods
6. To comprehend the capacity and signalized intersection analysis
7. To understand the basic knowledge of ITS

Course content:

Properties of traffic engineering elements:

Introduction to Traffic Engineering, Vehicle Characteristics, Human factors and driver Characteristics, Road Characteristics.

Proposed curriculum (Civil Engineering Department -NITAP)

Traffic engineering studies and analysis:

Introduction to traffic studies, Traffic volume studies, speed studies, origin and destination studies. Travel time and delay studies, parking studies, accident studies.

Traffic flow characteristics:

Nature of Traffic flow, Approaches to understand Traffic Flow, Parameters connected with Traffic flow, Categories of Traffic flow, Uninterrupted traffic flow model. Analysis of speed, flow and density relationship, Empirical studies of traffic stream Characteristics

. Fundamentals of interrupted traffic flow:

Shock waves, Traffic flow at signalized intersections, Traffic flow at unsignalized intersections.

Intersection control and design:

Introduction, Types of intersections, Design considerations, Traffic control devices, Conflict areas at intersections, Types of Intersection controls, Traffic signals, warrants for interchanges, Design of interchanges.

Highway capacity:

Introduction, Highway capacity, Level of service, basic freeway capacity studies, Multilane, Highway capacity, two lane Highway capacities.

Books:

1. Adolf D.May 'Traffic Flow fundamentals' Prentice Hall, 1989.
2. Mcshane and Roess 'Traffic Engineering' Prentice Hall, 1998.
3. L.R. Kadyali 'Traffic Engineering and Transport Planning' Khanna Publishers, 2008.
4. Patha Chakraborty and Animesh Das 'Principles of Transportation Engineering' PHI Learning, 2009.
5. Nicholas J. Garber, Lester A. Hoel 'Traffic & Highway Engineering' Cengage Learning, 2009.

Subject Code	Subject	L	T	P	C
CE-405C	Environmental Impact Assessment and Modelling	3	0	0	3

Course outcomes:

1. Describe the structure and function of major environmental systems
2. Identifying the basic principles of various ground improvement techniques.
3. Critically evaluate arguments regarding environmental issues.
4. Students will see the impact their own lives have on their environment.
5. Apply their understanding of environmental issues to their own choices

Course content:

Environmental assessment: Evolution of environmental impact assessment (EIA), EIA at project, regional and policy level; strategic EIA, EIA process, screening and scoping criteria, rapid and comprehensive EIA, specialized areas like environmental health impact assessment, environmental risk analysis, economic valuation methods, cost benefit analysis, expert system and GIS applications, uncertainties.

Proposed curriculum (Civil Engineering Department -NITAP)

Environmental policies and legislation: Legislative and environmental clearance procedures in India and other countries, sitting criteria, public participation, resettlement and rehabilitation.

Methodologies: Practical applications of EIA, EIA methodologies, baseline data collection, prediction and assessment of impacts on physical, biological and socio-economic environment, environmental management plan, post project monitoring, EIA report and EIS, review process

Environmental systems Modelling: Principles of modelling, classification; introduction to air quality models, meteorology, atmospheric stability and turbulence, Gaussian plume model and modification, numerical models, Transport and fate of pollutant in aquatic system, introduction to river, estuarine and lake hydrodynamics, stratification and eutrophication of lakes, dissolved oxygen model for streams, temperature models

Books:

1. Asit K. Biswas, "Environmental Impact Assessment for Developing Countries" United Nation University press. 1999
2. G.J. Rau and C.D. Wooten, "Environmental Impact Analysis Handbook" McGraw Hills publishers 1980
3. L. Canter, "Environmental Impact Assessment" McGraw Hill publishers, USA, 1996

Subject Code	Subject	L	T	P	C
CE-405D	Advanced Structural Analysis	3	0	0	3

Course Outcomes:

1. Analysis of plates, folded plates, curved shell.
2. Analysis of structures by stiffness matrix method.
3. Analysis of beams and frames.
4. Prediction and control of movements in buildings
5. Analysis of thin-walled structures
6. An ability to apply knowledge of mathematics, science and engineering in structural analysis.
7. Ability to identify, formulate, and solve structural engineering problem

Course content:

Introduction: Stiffness, flexibility, flexibility and stiffness matrices.

Matrix Methods in skeletal structural analysis: force and displacement methods, analysis of beams, frames and trusses including analysis using substructures.

Approximate Methods for Structural Analysis: Cantilever and portal methods two cycle moment distribution

Theory of Plates and Shells:

Analysis of plates, folded plates and singly curved shells: conventional and approximate methods.

Books:

1. Jan J. Tuma 'Advanced Structural Analysis' McGraw-Hill, New Delhi, 1971.
2. Igor A. Karnovsky, Olga Lebed 'Advance Method of Structural Analysis' Springer.
3. Sidney F. Borg, Joseph J. Gennaro 'Advanced Structural Analysis' Van Nostrand, 1959.
4. Devdas Menon 'Advanced Structural Analysis' Narosa, 2009.