

# COURSE STRUCTURE AND SYLLABUS FOR BTECH.

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DEPARTMENT OF CIVIL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY  
MIZORAM

## COURSE STRUCTURE

### SEMESTER-I

	Course Code	Course Title	L-T-P	Credit
1	HUL1101	Communicative English	3-0-0	6
2	MAL1101	Mathematics-I	3-1-0	8
3	PHL1101	Physics	3-0-0	6
4	MEL1101	Engineering Mechanics	3-0-0	6
5	CSL1101	Computer Programming	3-0-0	6
6	PHP1101	Physics Practical	0-0-2	2
7	MEP1101	Engineering Mechanics Practical	0-0-2	2
8	CSP1101	Computer Programming Practical	0-0-2	2
<b>TOTAL</b>			15-1-6 22	38

### SEMESTER-II

SI No	Course Code	Course Title	L-T-P	Credit
1	HUL1202	Social Science	2-0-0	4
2	MAL1202	Mathematics-II	3-1-0	8
3	CHL1201	Chemistry	3-0-0	6
4	EEL1201	Basic Electrical Engineering	3-0-0	6
5	MEL1202	Engineering Drawing	4-0-0	8
6	EEL1201	Basic Electrical Engineering Practical	0-0-2	2
7	CHP1201	Chemistry Practical	0-0-2	2
8	MEP1203	Workshop	0-0-4	4
<b>TOTAL</b>			15-1-8 24	40

**SEMESTER-III**

SI No	Course Code	Course Title	L-T-P	Credit
1	CEL1301	Strength of Materials	3-0-0	6
2	CEL1302	Surveying	3-0-0	6
3	CEL1303	Fluid Mechanics	3-0-0	6
4	CEL1304	Building Materials	3-0-0	6
5	HUL1301	Managerial Economics	3-0-0	6
6	MAL1301	Mathematical Methods	3-0-0	6
7	CEP1301	Strength of materials Laboratory	0-0-3	3
8	CEP1302	Surveying Laboratory	0-0-3	3
9	CEP1303	Fluid Mechanics Laboratory	0-0-3	3
<b>TOTAL</b>			18-0-9 27	45

**SEMESTER-IV**

SI No	Course Code	Course Title	L-T-P	Credit
1	CEL1405	Mechanics of Solids	3-1-0	8
2	CEL1406	Concrete Technology	3-0-0	6
3	CEL1407	Hydraulics and Hydraulic Machines	3-0-0	6
4	CEL1408	Transportation Engineering - I	3-0-0	6
5	CEL1409	Construction Technology and Project Management	3-0-0	6
6	MAL1401	Numerical Methods and Probability Theory	3-0-0	6
7	CEP1404	Concrete Laboratory	0-0-3	3
8	CEP1405	Hydraulics Laboratory	0-0-3	3
<b>TOTAL</b>			18-1-6 25	44

**SEMESTER-V**

Sl No	Course Code	Course Title	L-T-P	Credits
1	CEL1510	Structural Analysis – I	3-1-0	8
2	CEL1511	Design of R.C. Structures	3-1-0	8
3	CEL1512	Engineering Hydrology	3-0-0	6
4	CEL1513	Environmental Engineering - I	3-0-0	6
5	CEL1514	Geotechnical Engineering – I	3-1-0	8
6	CEP1506	Geotechnical Laboratory	0-0-3	3
7	CEP1507	Environmental Laboratory	0-0-3	3
<b>TOTAL</b>			15-3-6 24	42

**SEMESTER-VI**

SL No	Course Code	Course Title	L-T-P	Credits
1	CEL1615	Design of Steel Structures	3-0-3	9
2	CEL1616	Structural Analysis-II	3-1-0	8
3	CEL1617	Geotechnical Engineering – II	3-0-0	6
4	CEL1618	Transportation Engineering - II	3-0-0	6
5	CEL1619	Environmental Engineering - II	3-0-0	6
6	CEL1620	Irrigation and Hydraulic Structures	3-0-0	6
7	CEP1608	Transportation Laboratory	0-0-3	3
<b>TOTAL</b>			18-1-6 25	44

## SEMESTER-VII

Sl No	Course Code	Course Title	L-T-P	Credit
1	CED1701	Project - I	0-0-8	8
2	CEL1721	Advanced Surveying	3-0-0	6
3	CEL1722	Engineering Geology	3-0-0	6
4	CEL1723	Building Planning and Sustainable Construction	3-0-0	6
5	CEP1709	Advanced Surveying Laboratory	0-0-3	3
6	CEP1710	Geology Laboratory	0-0-3	3
7	CEP1711	Computational Laboratory	0-0-3	3
<b>TOTAL</b>			9-0-17 26	35

## SEMESTER-VIII

Sl No	Course Code	Course Title	L-T-P	Credit
1	CED1802	Project - II	0-0-12	12
2	CEL1824	Quantity Surveying and Public Works	3-0-0	6
3	CEL18XX	Elective - I	3-0-0	6
4	CEL18XX	Elective - II	3-0-0	6
5	CEL18XX	Elective - III	3-0-0	6
<b>TOTAL</b>			12-0-12 24	36

Semester/Year	1 <sup>st</sup> Year	III Sem	IV Sem	V Sem	VI Sem	VII Sem	VIII Sem
Credit	78	45	44	42	44	35	36
<b>Total</b>							<b>324</b>

## LIST OF ELECTIVES

### ELECTIVE-I

1. CEL18XX-AIR AND NOISE POLLUTION
2. CEL18XX-DESIGN OF HYDRAULIC STRUCTURES
3. CEL18XX-SITE INVESTIGATION AND GROUND IMPROVEMENT
4. CEL18XX-TRAFFIC ENGINEERING
5. CEL18XX-PRE-STRESSED CONCRETE
6. CEL18XX-STRUCTURAL DYNAMICS
7. CEL18XX-DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

### ELECTIVE-II

1. CEL18XX-INDUSTRIAL WASTE MANAGEMENT
2. CEL18XX-GROUNDWATER
3. CEL18XX-DESIGN OF FOUNDATION AND RETAINING STRUCTURES
4. CEL18XX-PAVEMENT ENGINEERING
5. CEL18XX-BRIDGE ENGINEERING
6. CEL18XX-ADVANCED RC DESIGN
7. CEL18XX-ENVIRONMENTAL IMPACT ASSESSMENT

### ELECTIVE-III

1. CEL18XX-SOLID WASTE MANAGEMENT
2. CEL18XX-EARTHQUAKE GEOTECHNICAL ENGINEERING
3. CEL18XX-ADVANCED TRANSPORTATION MODELLING
4. CEL18XX-GROUND WATER AND SURFACE WATER POLLUTION
5. CEL18XX-FINITE ELEMENT ANALYSIS
6. CEL18XX-SOIL DYNAMICS
7. CEL18XX-AIRPORT PLANNING AND DESIGN

## COURSE SYLLABUS

### CEL1301 STRENGTH OF MATERIALS

#### 1. Course Description:

Strength of Materials introduces you to the concept of stress, strain and deformation of solid and state of stress. It will also introduce the elastic constants and mechanical properties. The concept of shear force and bending moment diagram will be discussed. It focuses on the concepts of bending stresses and shear stresses in beams. The behavior of structural elements under flexure, torsion is emphasized at the end of the course.

#### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Determine the strength parameters of the materials.
- Know more about the concepts of stress and strain.
- Determine shear force, bending moment, bending and shear stress distribution.
- Analyze members subjected to torsion.

#### 3. Broad Course Outline:

- Stress and strain.
- Elastic constants and Mechanical properties.
- Members in uniaxial state of stress.
- Shear Force and Bending Moment Diagram.
- Theory of simple bending.
- Shear stress distribution.
- Torsion of Circular Shafts.

#### 4. Readings:

- a) Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi, 1996.
- b) Beer and Johnston, Mechanics of Materials, McGraw Hill International Edition, 1995.
- c) E. Popov, Engineering Mechanics of Solids, Prentice Hall of India Pvt. Ltd., 1998.
- d) R. Subramanian, Strength of Materials, Oxford University Press, 2010.

#### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Stress and Strain</b>			
	Concept of stress, normal stress and shear stress, Cartesian components of stress at a point, Concept		

	of strain, normal and shear strain, Poisson's ratio, Volumetric strain, Concept of strain energy.		
<b>Elastic constants and Mechanical properties</b>			
	Hooke's law, Modulus of rigidity and bulk modulus-Relation between E, G and K, Proof stress, Stress-strain diagrams for brittle and ductile materials, Hardness and impact strength.		
<b>Members in uniaxial state of stress</b>			
	Members in uniaxial state of stress: Uniform cross section and tapered bars subjected to uniaxial tension and compression, Composite bars.		
<b>Shear Force and Bending Moment Diagram</b>			
	Types of supports-Types of determinate beams-Simply supported, Cantilever, Overhanging and Compound beams with articulations-Shear force and Bending moment diagrams-Principles of Superposition, Shear force and Bending Moment diagram for moving load.		
<b>Theory of simple bending</b>			
	Assumptions-Theory of simple bending-Bending stresses in beams-Discussion of efficiency of various shapes of cross sections.		
<b>Shear stress distribution</b>			
	Flexural shear stress distribution in various shapes of cross section of beams.		
<b>Torsion of Circular Shafts</b>			
	Theory of pure torsion in solid and hollow circular shafts-Torsional shear stresses and angle for twist-transmission of power.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1302 SURVEYING-I

### 1. Course Description:

Surveying introduces you to basics of linear/angular measurement methods like chain surveying, compass surveying. It mainly focuses on the concepts of errors, accuracy and precision. Later it



focuses on significance of plane table surveying in plan making. It focuses on measurements in vertical plane using leveling and contouring. Lastly it provides introduction to modern surveying equipments like Theodolite, Electronic Distance Measurement and Total Station.

## 2. Learning Outcome:

On completion of the course, the students will be able to:

- Carry out preliminary surveying in the field of civil engineering applications.
- Know more about the use of chain surveying and compass surveying.
- Use various conventional instruments involved in surveying with respect to utility and precision.
- Know more about leveling and contouring and implement them in the field of surveying.
- Know the use of modern equipments (Theodolite, EDM, Total station) in curve setting, area and volume calculations

## 3. Broad Course Outline:

- Introduction.
- Chain surveying.
- Compass surveying.
- Errors, Accuracy and Precision.
- Plane table surveying.
- Leveling and contouring.
- Introduction to Theodolite, EDM and Total Station.

## 4. Readings:

- a) B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying-I & II, Laxmi Publications,2005.
- b) Chandra A.M., Higher Surveying, New Age International Publishers, 2007.
- c) Chandra A.M., Plane Surveying, New Age International Publishers, 2007

## 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
	<b>Introduction</b>		
	Surveying objectives, plane surveying principles and classification, scales, linear measurements, instruments for surveying, preparation of map and plan.		
	<b>Chain surveying</b>		
	Measurement of distance, chain surveying		

	principles, selection of stations, offsets, locating building corners, field book, chain surveying instruments, conventional signs.		
<b>Compass surveying</b>			
	Measurement of directions and angles, types of compass, meridians and bearings, local attraction, magnetic declination, traversing with a chain and compass, plotting of traverse.		
<b>Errors, Accuracy and Precision</b>			
<b>Plane table surveying</b>			
	Principle and instruments used in plane table surveying, working operations, methods of plane table surveying.		
<b>Leveling and contouring</b>			
	Description of a point (position) on the earth's surface, instruments for leveling, principle and classification of leveling, bench marks, leveling staff, readings and booking of levels, field work in leveling, longitudinal section and cross section, plotting the profile, height (level) computations, contours, characteristics of contours, contours of natural features, methods of contouring, interpolation, contour gradient, contour maps.		
<b>Introduction to Theodolite, EDM and Total Station</b>			
	Introduction to Theodolite, Principle of measuring angles and distances, Principle of electronic distance measurement( EDM), Introduction to total station and its applications like curve setting, area and volume measurement, etc.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1303 FLUID MECHANICS

### 1. Course Description:

Fluid Mechanics introduces you to the properties of fluids, and principle of conservation of mass & momentum and their applications. It focuses on the concepts of the fluid flow, kinematics of

flow and dynamics of fluid flow. It emphasizes the important concepts of continuity equation, Bernoulli's equation and Momentum equation in problem solving. Lastly it focuses on the concepts of laminar and turbulent flows.

## 2. Learning Outcome:

On completion of the course, the students will be able to:

- Determine the properties of fluid and fluid pressure and their measurement.
- Know more about the concepts of fluid flow and kinematics of flow and their applications.
- Know more about the dynamics of flow.
- Know the important equation like continuity equation and momentum equation.
- Compute the laminar and turbulent flow and its applications.

## 3. Broad Course Outline:

- Introduction.
- Principles of Fluid Statics.
- Description of fluid flow.
- Kinematics of Flow.
- Fluid Dynamics.
- Dimensional Analysis and Similitude.
- Boundary layer theory.
- Laminar and turbulent flow through pipes.

## 4. Readings:

- a) A.K. Jain, Fluid Mechanics, Khanna Publishers, Delhi, 2002.
- b) R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications(P) Ltd. New Delhi, 2002.
- c) Shames, Mechanics of Fluids, McGraw Hill Book Co.,2003.
- d) Streeter V.L., Benjamin Wylie and Bedford, Fluid Mechanics, McGraw Hill Book Co., 1998

## 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Introduction</b>			
	Properties of fluids, concept of continuum, viscosity, compressibility, ideal and real fluids, surface tension, cavitations.		
<b>Principles of Fluid Statics</b>			
	Stress at a point, pressure, Pascal's law, Variation of pressure with elevation in compressible and incompressible fluids, hydrostatic law, Pressure		

	measurement, piezometers and manometers, Hydrostatic forces exerted on submerged surfaces.		
<b>Description of fluid flow</b>			
	With reference to translation, rotation and deformation, concept of continuum, control mass & control volume approach, Reynolds transport theorem. Steady flow and uniform flow.		
<b>Kinematics of Flow</b>			
	Velocity field, one & two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, standard flow patterns, combination of flow patterns, flownet.		
<b>Fluid Dynamics</b>			
	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.		
<b>Dimensional Analysis and Similitude</b>			
	Dimensional Homogeneity, Buckingham's $\pi$ theorem, dimensionless numbers, similitude.		
<b>Boundary layer theory</b>			
	Concepts of boundary layer flows, Laminar and Turbulent boundary layers, Integral momentum equation of boundary layer flows, Boundary layer separation and control, Drag and lift.		
<b>Laminar and turbulent flow through pipes</b>			
	Laminar flow and its characteristics, Reynolds experiment, Laminar flow between parallel plates, Laminar flow through pipes, Hazen-Poiseuille equation, Turbulence, Reynolds turbulent stresses, Prandtl's mixing length theory, Velocity distribution in turbulent flow, Head loss in flow through pipes, Darcy Weisbach equation, major and minor losses.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1304 BUILDING MATERIALS

### 1. Course Description:

Building Materials introduces you to the properties of stones, characteristics of good building stones, properties of bricks, characteristics of a good building bricks. It introduces to the different types of cement and their uses. Later it focuses mainly on concrete and types of concrete and the different tests on concrete. Lastly, it focuses on the concepts of timber and wood based products, steel and aluminium and some new materials.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Determine the characteristics of a good building stone and their properties.
- Determine the characteristics of a good building bricks and their properties.
- Choose the particular cement needed for particular types of construction.
- Prepare concrete with correct proportions for different types of works.
- Know more about timber and wood based products.
- Know more about steel and aluminium, some new materials.

### 3. Broad Course Outline:

- Building stones.
- Brick & other clay products.
- Lime & cement.
- Mortar & concrete.
- Timber & wood based products.
- Steel & aluminium.
- Introduction to some new materials/composites.

### 4. Readings:

- a) B. C. Punmia, Building Construction, Laxmi Publication, 1993.
- b) P. C. Varghese, Building Materials, PHI Learning Pvt. Ltd., 2005.
- c) R.K. GUPTA, Civil engineering Materials and Construction Practices, Jain Brothers, (New Delhi).
- d) S.C. Rangwala, Building Construction, Charotar Publishing House, 1996.

### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
	Building stones		

	Classification of stones- Characteristics of good building stones, important types of building stones, their properties and stones and uses.		
<b>Brick &amp; other clay products</b>			
	Composition of brick-earth, manufacturing process of bricks, characteristics of good building bricks, classification and testing of bricks, special types of bricks and their uses. Types of tiles and their use in buildings. Terracotta, stoneware.		
<b>Lime &amp; cement</b>			
	IS classification of lime and uses, flow diagram of manufacturing process of cements, chemical composition of cement, IS specifications and tests on Portland cement, different types of cements and their uses.		
<b>Mortar &amp; concrete</b>			
	Preparation of cement mortar and concrete, proportion of mortars and concrete for different types of works, properties of concrete in plastic and hardened stages, factors affecting strength of concrete, types of concrete and their specific use.		
<b>Timber &amp; wood based products</b>			
	Classification of timber trees, cross section of exogenous tree, hard wood and soft wood, seasoning of timber, important types of timber and their uses, ply wood and its uses.		
<b>Steel &amp; aluminium</b>			
	Types of steel-mild steel, high carbon steel, high strength steel- properties and uses, commercial forms of steel and their uses.		
<b>Introduction to some new materials/composites</b>			
	Fly ash, Plastics, Paints, Plasticizers, AAC brick, Fibre Reinforced polymer, geopolymers, Ferro cement.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## **CEP1301 STRENGTH OF MATERIALS LABORATORY**

### **1. Course Description:**

The lab session will includes experiments on

- Finding Young's Modulus, Torsional strength, hardness and tensile strength of given specimens.
- Finding Impact value and crushing value on coarse aggregates.
- Finding stiffness of open coiled and closed coiled springs.
- Finding physical properties of given coarse aggregate, fine aggregate and cement samples.

### **2. Learning Outcome:**

On completion of the course, the students will be able to:

- Evaluate Young's modulus
- Evaluate torsional strength, hardness and tensile strength of given specimen.
- Find stiffness of open coiled and close coiled springs.

### **3. Broad Course Outline:**

- Test for flexural rigidity
- Torsion test
- Tensile test
- Hardness test
- Impact test
- Compression test
- Test on springs

## **CEP1302 SURVEYING LABORATORY-I**

### **1. Course Description:**

The Lab sessions would include experiments on:

- Chain Surveying
- Chain Traverse
- Compass Surveying
- Compass surveying Traversion
- Plane Table Surveying – Radiation, intersection, Traverse, Resection Leveling.
- Theodolite surveying and traversing
- Curve setting
- EDM
- Total Station

## 2. Learning Outcome:

On completion of the course, the students will be able to:

- use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling
- apply the procedures involved in field work and to work as a surveying team
- plan a survey appropriately with the skill to understand the surroundings
- take accurate measurements, field booking, plotting and adjustment of errors can be understood
- Plot traverses / sides of building and determine the location of points present on field on a piece of paper.
- Apply modern surveying techniques such as Theodolite, EDM and Total Station.

## 3. Broad Course Outline:

- Introduction & list of equipments
- Survey of an area by chain survey (closed traverse) & plotting.
- Compass Traversing.
- Radiation method, intersection methods by plane table survey.
- Traversing by plane table survey.
- Fly leveling (differential leveling).
- Grid Contouring.
- Indirect Contouring.
- Theodolite Surveying
- EDM, Total Station

## CEP1303 FLUID MECHANICS LABORATORY

### 1. Course Description:

The Lab sessions would include experiments on:

- Flow measurement in a pipe flow.
- Energy loss in pipe flow

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Calibrate flow measuring devices used in pipes, tanks and channels.
- Measure discharge in pipes.
- Determine fluid and flow properties
- Characterize laminar and turbulent flows.



### 3. Broad Course Outline:

- Calibration of Venturimeter, Orifice meter (discharge measuring device in pipes).
- Calibration of Orifice and Mouthpiece (discharge measuring device in Tanks).
- Calibration of Triangular Notch and Rectangular notch (discharge measuring device in Channels).
- Measurement of Viscosity of water.
- Determination of Darcy Friction Factor, relative roughness for laminar and turbulent flows.
- Determination of minor losses.

## CEL1405 MECHANICS OF SOLIDS

### 1. Course Description:

Mechanics of Solids introduces you to the principal stresses and strains, concept of Mohr's circle. Secondly, it focuses on calculation of critical load for compression members like columns and struts. It highlights the concept of shear centre and also discusses computation of stresses in thin and thick cylinders. It also emphasizes the concept of springs. Different failure theories will also be discussed at the end of the course.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Understand the concept of principal stresses and strains at a point.
- Determine deflection of a beam for various loading conditions with different support conditions.
- Analyze the stresses of different compression members subjected to different load.
- Understand the concept of shear centre, shear flow, thin and thick cylinders.
- Know the behavior of springs under loading
- Know the different failure theories.

### 3. Broad Course Outline:

- Principal Stresses and Strains at a Point.
- Columns and Struts.
- Shear Centre.
- Thin and Thick Cylinder
- Springs.
- Failure Theories.

### 4. Readings:

- a) E. Popov, Engineering Mechanics of Solids, Prentice Hall of India Pvt. Ltd., 1998.

- b) Junarkar. S. B and Shah H.J- Mechanics of Structures Vol 1 & Vol.2 – 27th Edition, Charotar Publishers, 2008.
- c) Timoshenko S.P. and Gere J.M. , Mechanics of Materials, Tata McGraw Hill, 1992.
- d) Stephen H. Crandall, Norman C.Dahl, Thomas J. Lardner, An Introduction to the Mechanics of Solids, McGraw Hill, 1999.

### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Principal Stresses and Strains at a Point</b>			
	Analysis of Biaxial state of stress at a point - Principal Planes - Principal stresses and strains - Mohr's Circle and its application to different cases - combined bending and torsion with or without end thrust - Equivalent Bending Moment and Equivalent Twisting Moment, Unsymmetrical bending.		
<b>Columns and Struts</b>			
	Direct and Bending stresses - Kernel of a section - Euler's critical load for columns with ordinary end conditions - Slenderness ratio and effective length of a column - Rankine's Formula - IS Code formula - Critical load of eccentrically loaded columns.		
<b>Shear Centre</b>			
	Concept of Shear Centre – Shear Centre of various cross sections – Shear flow – Shear lags		
<b>Thin and Thick Cylinder</b>			
	Introduction, thin cylinders under internal pressure, difference between thick and thin cylinders, Lamé's theory, thick cylinders under internal pressure and external pressure.		
<b>Springs</b>			
	Types and classification of springs – Analysis of Close and open coiled helical springs subjected to axial load and axial twist – Strain energy of springs.		
<b>Failure Theories</b>			
	(1) Maximum Principal Stress Theory (2) Maximum Principal Strain Theory (3) Maximum Shear Stress Theory (4) Total Energy Theory (5)Distortion energy theory, Application to shafts under the action of combined bending and torque.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1406 CONCRETE TECHNOLOGY

### 1. Course Description:

Concrete Technology introduces you to the different materials for construction like cement, aggregate and admixtures. Different tests were conducted for the different materials. Concrete is formed from these aggregates and different tests were conducted for fresh and hardened concrete and focuses on the properties of concrete. Lastly, it focuses on the concepts of mix design.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Know more about the different materials for construction.
- Test all the concrete materials as per IS code.
- Design the concrete mix using IS code method.
- Determine the properties of fresh and hardened of concrete.
- Design special concretes and their specific applications.
- Ensure quality control while testing/ sampling and acceptance criteria.

### 3. Broad Course Outline:

- Concrete Making Materials.
- Hydration of Cement.
- Quality tests on cement.
- Aggregates.
- Fresh concrete.
- Hardened concrete.
- Durability.
- Concrete Mix design.
- Special concrete.

### 4. Readings:

- a) M.S. Shetty, Concrete Technology, S Chand Co., Publishers, 2006.
- b) M.L. Gambhir, Concrete Technology Theory and Practice, Tata McGraw Hill Publishers, 5<sup>th</sup> edition.

c) A.M. Neville, Properties of Concrete, Longman Publishers, 2004.

### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Concrete Making Materials</b>			
	Cement, Fine Aggregate, Coarse aggregate, Water, Chemical & Mineral admixtures.		
<b>Hydration of Cement</b>			
	Bogue's compounds, Hydration, Gel formation, Types of cement, pore & capillary water.		
<b>Quality tests on cement</b>			
	Different test on cement as per Indian standards.		
<b>Aggregates</b>			
	Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis – Grading.		
<b>Fresh concrete</b>			
	Properties of fresh concrete- Workability – different tests of workability- Factors influencing workability compaction, finishing, curing.		
<b>Hardened concrete</b>			
	Tests on hardened concrete as per IS codes – Relationship between different strengths – factors influencing strength, NDT techniques.		
<b>Durability</b>			
	Factors influencing durability – Chemical effects on concrete- Carbonation, Sulphate attack, Chloride attack.		
<b>Concrete Mix design</b>			
	Different methods of mix design – factors affecting mix design – exercises.		
<b>Special concrete</b>			
	Heavy density concrete, underwater concrete, self-compacting concrete, light weight concrete, mass concrete.		

### 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## **CEL1407 HYDRAULICS AND HYDRAULIC MACHINES**

### **1. Course Description:**

Hydraulic and hydraulic structures introduce you to the flow through pipes and channels. Further it focuses mainly on the uniform and non-uniform flow, steady and unsteady flow. It focuses mainly on the impact of jet on different conditions of plate. It also focuses on measurements of flow in open channels. It gives introduction to sediment transport. Later it focuses on the classification of hydraulic machines like pumps and turbines.

### **2. Learning Outcome:**

On completion of the course, the students will be able to:

- Know the properties of flow through channels and pipes.
- calculate forces and work done by a jet on fixed or moving plate and curved plates
- Know more about the flow measurement in open channels.
- select the type of turbine required with reference to available head of water and discharge
- Determine the characteristics of hydraulic machines like centrifugal pump and reciprocating pump.

### **3. Broad Course Outline:**

- Introduction to Free surface flows.
- Uniform flow in Open channels.
- Steady Gradually Varied Flow.
- Steady Rapidly Varied flow.
- Unsteady flow.
- Introduction to sediment transport
- Flow measurement in open channels.
- Principles of impingement of jets.
- Hydraulic Similitude
- Turbines.
- Centrifugal pump.
- Reciprocating pump.

### **4. Readings:**

- a) Bansal R.K., A text book of Fluid Mechanics and Hydraulic Machines, Laxmi Publications(P) Ltd., New Delhi, 2002.
- b) R.S. Khurmi, Text book of Hydraulics and Hydraulic Machine, S.Chand & Co., 2003.
- c) C.S.P. Ojha, P.N. Chandramouli, R.Berndtsson, Fluid Mechanics and Machinery, Oxford University Press, 2010.

## 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Introduction to Free surface flows</b>			
	Comparison between pipe and channel flows, classification of channels and basic equations of flow.		
<b>Uniform flow in Open channels</b>			
	Specific energy, Critical flow, Channel transitions, Uniform flow formulae, best hydraulic sections.		
<b>Steady Gradually Varied Flow</b>			
	Non uniform flow in open channels, gradually varied flow equation, Type of GVF profiles, Computation of GVF profiles.		
<b>Steady Rapidly Varied flow</b>			
	Steady Rapidly Varied flow: Hydraulic jump in a horizontal rectangular channel, specific force, Computation of energy loss.		
<b>Unsteady flow</b>			
	Celerity of gravity wave, Monoclonal rising wave, Positive and Negative surges, St. Venant's equations, Method of characteristics, Hydraulic routing.		
<b>Introduction to sediment transport</b>			
	Incipient motion and Shield's theory		
<b>Flow measurement in open channels</b>			
	Broad and sharp- crested weirs, free overall, and flow over spillways, sluice gates.		
<b>Principles of impingement of jets</b>			
	Impact of jet on a stationary vertical plate, stationary inclined plate, and stationary curved plate, hinged plate, moving vertical and inclined plates, moving curved plate and on series of moving flat and curved vanes fixed on the periphery of circular rim.		
<b>Hydraulic similitude</b>			
	Review of Dimensional analysis, Similarity laws, and Model studies.		
<b>Turbines</b>			
	Classification, impulse turbines- Pelton wheel, Reaction turbines - Francis and Kaplan Turbines, Governing of a Francis turbine - Performance of turbines - specific speed and their significance.		
<b>Centrifugal pump</b>			
	description and working , Head, discharge and efficiency of a centrifugal pump, pressure rise in the pump, minimum starting speed of a pump, cavitations , priming, multistage pumps,		

	characteristic curves.		
<b>Reciprocating pump</b>			
	Description and working , types , discharge and slip, power required to drive the pump, Indicator diagram, Air vessel, work done against friction with and without air vessels.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1408 TRANSPORTATION ENGINEERING – I

### 1. Course Description:

Transportation Engineering-I introduces you to planning of highway network, design of cross section elements, preparing final report and master plan. Further it emphasizes on the alignment geometric design of highway and the geometric design of highway plan. In the later part, it focuses on the traffic characteristics, management and control, and its regulations. Lastly it focuses on the concepts of railway engineering.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Carry out surveys involved in planning and highway alignment.
- Design cross section elements, sight distance, horizontal and vertical alignment.
- Implement traffic studies, traffic regulations and control, and intersection design.
- Know more about railway engineering and its characteristics.

### 3. Broad Course Outline:

- Highway Network Planning.
- Highway Alignment and Geometric Design.
- Traffic Engineering.
- Traffic Management and Control.
- Introduction to Railway Engineering.

#### 4. Readings:

- a) Kadiyali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, India, 2008.
- b) Khanna, S.K. and C.E.G. Justo Highway Engineering, Nem Chand and Bros, Roorkee, India, 2001.
- c) P. Chakraborty and A. Das, Principles of Transportation Engineering, Prentice Hall India
- d) C. S. Papacotas and P. D. Prevedouros, Transportation Engineering and Planning, Hall India, 2001.
- e) Ministry of Road Transport and Highways. Specifications for Road and Bridge Works, Fourth Edition, Indian Roads Congress, New Delhi, India, 2001.
- f) IRC Codes of Practices.
- g) S.C Saxena, S.P Arora, A textbook of Railway Engineering, Dhanpat Rai, 2001.

#### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Highway Network Planning</b>			
	Different modes of transportation, role of highway transportation, classification, network patterns, planning surveys, preparation of plans, final report, master plan, evaluation by saturation system, 20 year road development plans, salient features, determination of road lengths.		
<b>Highway Alignment and Geometric Design</b>			
	Principles of highway alignment, requirements, controlling factors, engineering surveys, importance of geometric design, design controls and criteria, cross section elements, pavement surface characteristics, camber, carriageway, kerbs, road margins, formation, right of way, typical cross sections. Sight distance, stopping sight distance, overtaking sight distance, sight distance at intersections. Design of horizontal alignment, super elevation, transition curves. Design of vertical alignment, gradients, vertical curves.		
<b>Traffic Engineering</b>			
	Traffic characteristics; components of traffic stream, flow-speed Density, measurement and analysis, q-k-v relationships, design hourly volume, concept of PCU, capacity and level of service(LOS). Parking studies and accident studies. Design of intersections, at grade		



	intersections, channelized and rotary. Introduction to grade separated intersections, cloverleaf interchange, trumpet interchange, flyovers.		
<b>Traffic Management and Control</b>			
	Traffic regulations, one-way streets, traffic signs, road markings, signals, warrants. Design of isolated fixed time signal, introduction to signal coordination.		
<b>Introduction to Railway Engineering</b>			
	Universal scenario and Indian railways, terminologies used in railways, track design, rails and their requirements, creep and wear in rails, rail joints, types of sleepers, requirement of ballast, track fastening, check rails and guard rails. Railway cross sections, various types of gradients.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1409 CONSTRUCTION TECHNOLOGY AND PROJECT MANAGEMENT

### 1. Course Description:

Construction Technology and Project Management introduces you to the concepts of engineering economics, it focuses on the importance of Project Management, the role of a project manager. It focuses on the knowledge and processes involved in construction projects. Later it focuses on the different types of equipments used for construction. Lastly it mainly focuses on the finance in construction.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Able to make a correct decision.
- Know more about the role of a project manager.
- Emphasize the importance of project management.
- Take up a project on construction in a well-planned and systematic way.

- Know more about the different equipments for construction.
- Estimate the required finance in construction projects.
- Know more about entrepreneur and entrepreneurship.

### 3. Broad Course Outline:

- Introduction to Engineering Economics
- Project Management
- Construction Project
- Construction Equipment and Management
- Entrepreneur and Entrepreneurship

### 4. Readings:

- a) F. Harris, R. MacCaffer and F. Edum-Fotwe, Modern Construction Management, Blackwell publishing, 2006.
- b) C. J. Schexnayder and R. E. Mayo, Construction Management Fundamentals, McGraw Hill, New Delhi, 2003.
- c) Peurifoy, Construction Planning, Equipment and Method, Tata McGraw Hill Educations, 2010.
- d) B.C. Punmia and K.K. Khandelwal, Project Planning and Control with PERT and CPM, Motilal UK Books of India, 2002.
- e) S.C. Sharma, Construction Equipment and Management, Khanna Publishers.

### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Introduction to Engineering Economics</b>			
	Engineering decision makers, Engineering and Economics, Problem solving and decision making, Intuition and analysis, economic models, demand and supply, interest rate, economic analysis of engineering projects, project feasibility reports, problems on above.		
<b>Project Management</b>			
	Importance of Project Management, Role of Project manager.		
<b>Construction Project</b>			
	Stakeholders in construction project, Different types of projects, similarities & dissimilarities in projects. Time, Scope & Money, Knowledge areas & Processes involved in construction projects, WBS of a major work, with		

	examples, Planning, monitoring & executing, Planning, sequencing, scheduling, Bar Charts, Networks, CPM, PERT, Upgrading, Cash flow diagram		
<b>Construction Equipment and Management</b>			
	Introduction, Management of construction, Materials management, equipments management in construction projects, earth moving equipments, hoisting equipments, factors for selecting equipment.		
<b>Entrepreneur and Entrepreneurship</b>			
	Concept of Entrepreneur, characteristics of an Entrepreneur, distinction between an Entrepreneur and a Manager, Functions of Entrepreneur, Types of Entrepreneur, Concept of Entrepreneurship, Role of Entrepreneurship in Economic Development.		

#### 6. Evaluation plan:

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

### CEP1404 CONCRETE LABORATORY

#### 1. Course Description:

The Lab sessions would include experiments on:

- Cement.
- Aggregates.
- Concrete.
- Non-destructive test equipments
- Mix design.

#### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Conduct Quality Control tests on concrete making materials.
- Conduct Quality Control tests on fresh & hardened concrete.

- Design and test concrete mix.
- Conduct Non-destructive tests on concrete.

### 3. Broad Course Outline:

- Determination of Fineness and Specific Gravity of cement
- Determination of consistency of standard Cement Paste
- Determination of initial and Final Setting times of Cement
- Determination of Compressive Strength of Cement.
- Determination of Fineness modulus of Coarse and Fine Aggregates
- Determination of percentage of voids, Bulk density, Specific Gravity of coarse and Fine Aggregates.
- Workability Tests: Slump Cone Test, Compaction factor test, Vee-Bee consistometer Test
- Preparing and curing concrete specimens for tests & Determination of compressive strength of concrete cubes
- Experiments to demonstrate the use of non-destructive test equipment like rebound hammer, ultrasonic pulse velocity, permeability, corrosion and core cutter.
- Mix Design: IS Code method

## CEP1405 HYDRAULICS LABORATORY

### 1. Course Description:

The Lab sessions would include experiments on:

- Determination of Manning's and Chezy's coefficients.
- Energy loss in hydraulic jump.
- Velocity distributions.
- Pressure drag coefficient.
- Pumps and turbines.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Determine Manning's and Chezy's coefficients for smooth and rough channels.
- Determine Energy loss in Hydraulic jump.
- Test the performance of pumps and turbines.
- Compute drag coefficients.

### 3. Broad Course Outline:

- Determination of Manning's and Chezy's coefficients for smooth and rough channels by gradually varied flow method.

- Determination of Energy loss in Hydraulic jump.
- Determination Velocity distributions in open channels.
- Computation of pressure drag coefficient for flow past a cylinder in a subsonic wind tunnel.
- Performance Characteristics of single stage centrifugal pump, multi stage centrifugal pump,
- Submersible pumps, and varying speed centrifugal pump.
- Performance Characteristics of Pelton turbine, Francis turbine, and Kaplan turbine.

## **CEL1510 STRUCTURAL ANALYSIS-I**

### **1. Course Description:**

Structural Analysis introduces you to different types of structures and loads on the structures. The different methods of analysis of determinate and indeterminate structures are also discussed. Analysis of trusses, arches and cables are discussed in detail. Later, it focuses on the Force method of analysis of indeterminate structures. Lastly, it emphasizes on the concepts of influence line diagrams.

### **2. Learning Outcome:**

On completion of the course, the students will be able to:

- Use various methods of analysis of determinate structures.
- Use force method of analysis of indeterminate structures.
- Apply the concept of ILD and moving loads on beams, frames and arches.

### **3. Broad Course Outline:**

- Types of Structures and Loads
- Methods of Analysis
- Analysis of Trusses.
- Arches and Cables.
- Deflections.
- Analysis of Indeterminate structures by Force Method.
- Influence lines.

### **4. Readings:**

- a) C.S. Reddy, Basic structural Analysis, 3<sup>rd</sup> edition, McGraw Hill Education(India) Pvt. Ltd.
- b) R. C. Hibbeler, Structural Analysis, 2<sup>nd</sup> Edition, Tata McGraw Hill, 2005.
- c) G.Pandit and S.Gupta, Theory of Structures, Vol-1, Tata McGraw Hill, New Delhi, 1999.
- d) T.S. Thandavamoorthy, Structural Analysis, Oxford University Press, 2011.

## 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Types of Structures and Loads</b>			
	Different types of structures, Loads on structural system.		
<b>Methods of Analysis</b>			
	Static and kinematic indeterminacy, Equilibrium equations, Compatibility requirements, Introduction to Force and Displacement methods of analysis.		
<b>Analysis of Trusses</b>			
	Analysis of plane truss, compound truss, complex truss, space truss.		
<b>Arches and Cables</b>			
	Arches and Suspension cables, Three hinged arches and Suspension cables		
<b>Deflections</b>			
	Deflection of beams, Various methods for calculation of Deflection: Moment area theorem, Conjugate beam method, Double Integration method, Energy methods: Principle of minimum potential energy, principle of virtual work, Castigliano's theorem.		
<b>Analysis of Indeterminate Structures by Force Method</b>			
	Reciprocal theorem, Force Method of Analysis of Beams, Frames and Trusses.		
<b>Influence Lines</b>			
	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, Muller-Breslau Principle with applications to determinate and indeterminate structures, Qualitative ILD for continuous beams, frames and arches.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20

3	End semester examination	50
Total		100

## CEL1511 DESIGN OF R.C. STRUCTURES

### 1. Course Description:

Design of R.C. structures introduces you the concepts of working stress method and limit state method. The codal provisions of IS 456:2000 used for design will be discussed. It focuses on the design of singly reinforced section with the three modes of failure-balanced, over-reinforced and under-reinforced. It focuses on the design of doubly reinforced section. Later the concepts of shear and bond design of RC structures are studied. The design of RC flanged beams, slabs-one way and two way slab, continuous slabs and beams, columns and footings are studied in detail.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Apply the fundamental concepts of working stress method and limit state method.
- Use IS code of practice for the design of concrete elements.
- Know more about the concepts of bond.
- Design the beams, slab, column and footing.
- Draw various RC structural elements.

### 3. Broad Course Outline:

- Introduction.
- Design philosophies.
- Analysis and Design of Singly Reinforced Beams.
- Analysis and Design of Doubly Reinforced Beams.
- Analysis and Design of Flanged Beams.
- Shear and Bond design of RC.
- Design of RC Slabs.
- Design of Continuous Slab and Beams.
- Design of RC Columns.
- Design of RC Footings.
- Design for Serviceability.

### 4. Readings:

- a) S. Unnikrishna Pillai, Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill Education, 2003.
- b) N. Subramanian, design of Reinforced Concrete Structures, Oxford University Press, 2013.
- c) P.C. Varghese, Limit State Design of Reinforced Concrete, 2<sup>nd</sup> Edition, PHI, 2009.

d) IS 456:2000, IS 3370(Part-IV), BIS 2000.

### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Introduction</b>			
	Review of Concrete making materials- Structural concrete- Grades- properties of Concrete- Modulus of elasticity-flexural strength-Characteristic and Design values-Partial safety factor.		
<b>Design philosophies</b>			
	Objectives of RC design -Working stress method-comparison of design approaches. Limit State method- Assumptions- Stress-Strain behavior of Steel and Concrete- Stress block parameters		
<b>Analysis and Design of Singly Reinforced Beams</b>			
	Analysis of Singly Reinforced RC Section- Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections- Moment of Resistance- Design parameters- Design examples.		
<b>Analysis and Design of Doubly Reinforced Beams</b>			
	Necessity of Doubly Reinforced sections- Analysis of Doubly Reinforced RC Section-Moment of Resistance- Design parameters- Design.		
<b>Analysis and Design of Flanged Beams</b>			
	Analysis of flanged RC section- Singly and Doubly reinforced-Effective flange width- Moment of Resistance- design examples.		
<b>Shear and Bond design of RC</b>			
	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.		
<b>Design for Torsion</b>			
	Equilibrium torsion and Compatibility torsion, General behavior of RC structures in Torsion, Design strength in Torsion, Design examples.		
<b>Design of RC Slabs</b>			
	Design of One and Two way slabs: Effect of edge conditions- Moment of resistance-Torsion reinforcement at corners- Design examples.		
<b>Design of Continuous Slab and Beams</b>			
	Effect of continuity- analysis of continuous beam/slab- Moment and shear coefficients for continuous beam/slab- Critical sections.		
<b>Design of RC Columns</b>			



	Design principles of RC columns- Assumptions- Rectangular and Circular columns- Helical reinforcement- Minimum eccentricity-Use of Interaction diagrams for Axial load and Moment.		
<b>Design of RC Footings</b>			
	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.		
<b>Design for Serviceability</b>			
	Concept of Serviceability- Deflection- Span to depth ratio- Short term-Long term deflection due to Shrinkage, Creep- Cracking-Crack width calculation.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1512 ENGINEERING HYDROLOGY

### 1. Course Description:

Engineering Hydrology focuses on the brief introduction on precipitation and characteristics of precipitation with special emphasis on India. It mainly focuses on rainfall runoff characteristics. Later it focuses on the measurement of stream flow and catchment characteristics. It focuses on the concepts of hydrograph, floods and groundwater.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Know more about the type and characteristic of precipitation and their measurement.
- Apply the concepts of rainfall runoff relationship for computing water and sediment yield from catchment.
- Draw the hydrograph from the given precipitation.
- Estimate the peak discharge.
- Know more about the concepts of flood routing and groundwater.

### 3. Broad Course Outline:

- Introduction.
- Precipitation.
- Abstractions from Precipitation.
- Stream Flow Measurement.
- Hydrograph Theory.
- Introduction to Universal Soil Loss Equation
- Floods.
- Flood Routing.
- Groundwater.

### 4. Readings:

- a) Subramanya, K., 2008, Engineering Hydrology, Tata Mc Graw Hill Pub. Co., New Delhi
- b) H.M.Raghunath, Hydrology: Principles, Analysis and Design, New Age International, 2006.
- c) P. Jaya Rami Reddy, A Text Book of Hydrology, Laxmi Publications, 2011.

### 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Introduction</b>			
	Description of Hydrologic Cycle, Overview of application of hydrology in engineering. Forms and types of precipitation, basic concepts of weather systems, characteristics of precipitation in India.		
<b>Precipitation</b>			
	Measurement of precipitation, types of rain gauges, rain gauge network, collection and presentation of rainfall data, Test for consistency and continuity of data, analysis of rainfall data, average precipitation over an area, intensity-duration-frequency analysis and depth-area duration analysis.		
<b>Abstractions from Precipitation</b>			
	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.		

<b>Stream Flow Measurement</b>		
	Methods of measurement of stream flow, stage-discharge relationship, Runoff characteristics, catchment characteristics effecting the runoff, yield from a catchment, flow duration curve and flow mass curve.	
<b>Hydrograph Theory</b>		
	Components of hydrograph, base flow separation, direct runoff hydrograph, Unit hydrograph theory, derivation of unit hydrograph, S-hydrograph and instantaneous unit hydrograph, Derivation of unit hydrograph for ungauged catchments, conceptual models.	
<b>Introduction to Universal Soil Loss Equation</b>		
	USLE, its different components: rainfall erosivity factor, soil erodibility factor, slope-length ratio, cover factor and practice factor	
<b>Floods</b>		
	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.	
<b>Flood Routing</b>		
	Concepts of flow routing, hydraulic and hydrologic routing, Reservoir routing, Channel routing, Muskingum and Muskingum-Cunge methods of channel routing and flood forecasting.	
<b>Groundwater</b>		
	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.	

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50

Total	100
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## CEL1513 ENVIRONMENTAL ENGINEERING – I

### 1. Course Description:

Environmental Engineering-I introduces you to the Public Water Supply Scheme, water demand and population forecasting and then source of water supply-surface and sub surface. Later it focuses mainly on water quality requirement – physical, chemical and biological. Then the collection and conveyance of water will be highlighted. Later it focuses mainly on treatment of water as per requirement. Lastly it focuses on the distribution process, operation and maintenance of water supply.

### 2. Learning Outcome:

On completion of the course, the students will be able to:

- Identify the source of water and water demand.
- Apply the water treatment concept and methods.
- Apply the concepts of collection and conveyance of water.
- Know more about the water treatment process.
- Apply water distribution processes and operation and maintenance of water supply.

### 3. Broad Course Outline:

- Introduction and scope.
- Source of Water.
- Water Quality.
- Collection and conveyance of water.
- Water Purification.
- Distribution System.

### 4. Readings:

- a) Peavy H. S., Rowe D. R. and George Tchobanoglous, Environmental Engineering, McGraw-Hill International.
- b) B.C. Punmia, Ashok Kumar Jain, Arun K Jain, Water Supply Engineering, Laxmi Publications, 2<sup>nd</sup> Edition.
- c) Davis M. L and Cornwell D., Introduction to Environmental Engineering, A McGraw-Hill, Inc.

## 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Introduction and scope</b>			
	Public Water Supply Scheme Objectives, Planning and Components, Water Demand, Population forecasting, design period, estimation of water demand for various uses, factors affecting consumption and fluctuation of water demand.		
<b>Source of Water</b>			
	Surface source, types, selection, storage reservoir, yield and capacity estimation. Sub-surface water, types.		
<b>Water Quality</b>			
	The hydrologic cycle and water quality parameters: physical, chemical and biological, water quality requirements and standards.		
<b>Collection and conveyance of water</b>			
	Intakes, types of intakes, factors governing location of intakes, pumps, types of conduits, types of pipes.		
<b>Water Purification</b>			
	Water treatment, operation involved in water treatment, Design and operation of Sedimentation tanks, Aeration, Coagulation and Flocculation, design and operation of Filtration units, Disinfection, Hardness Removal, Fluoride and Arsenic Removal, Household Water Treatment Systems, Miscellaneous Methods, Flow-sheets for treatment of surface and sub-surface waters.		
<b>Distribution System</b>			
	Requirements, Classification, Analysis and Design of distribution systems, Detection and Prevention of wastage of water in distribution system.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## **CEL1514 GEOTECHNICAL ENGINEERING-I**

### **1. Course Description:**

Geotechnical Engineering -I introduces you to the importance of Geotechnical Engineering with emphasis on physical characterization and classification of soil. It focuses on the soil water interaction phenomena like capillarity, permeability, and seepage, flow net and effective stress. The course also highlights the stress and strain based concept such as stress distribution, compaction, consolidation and shear stress. Further it addresses the issues of slope stability.

### **2. Learning Outcome:**

On completion of the course, the students will be able to:

- Characterize and classify soils
- Identify shear strength parameters from field and laboratory investigation
- Compute and analyze the consolidation characteristics of soil
- Understand the principles of compaction and its control
- Analyze stability of soil slopes

### **3. Broad Course Outline:**

- Physical properties of soil
- Classification of Soils
- Soil Water
- Compaction of Soils
- Stress distribution in Soils.
- Consolidation
- Shear Strength
- Stability of Soil Slopes

### **4. Readings:**

- a) Gopal Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics, New Age International Pvt.Ltd, New Delhi, 2007.
- b) V.N.S. Murthy , Soil Mechanics and Foundation Engg, CBS Publications, New Delhi. 2007.
- c) B.C. Punmia, Ashok K Jain, Arun K Jain, Soil Mechanics and Foundations, Laxmi Publications(P) Ltd., 2005.
- d) B. M. Das, Principles of Geotechnical Engineering, Cengage Learning India Pvt. Ltd., New Delhi, 2013.
- e) Alam Singh, Soil Engineering: In Theory and practice: Fundamentals and General Principles, CBS Publishers, 2012.

## 5. Session Plan:

No of Sessions	Topics Covered	Readings	Date
<b>Physical properties of soil</b>			
	Soil formation- Development of soil mechanics- Importance of soil engineering- Major soil deposits of India, basic Definitions and Relationships: 3-phase soil system, volumetric relationships and weight volume relationships, determination of Index Properties: Water content, Specific gravity, Grain size distribution by sieve and hydrometer analysis, Relative density, Atterberg's limits and indices.		
<b>Classification of Soils</b>			
	Classification of soil systems – Particle size classification, Textural classification, AASHTO classification, Unified soil classification and Indian soil classification-Field identification of soils.		
<b>Soil Water Interaction Phenomena</b>			
	Types of soil water, Capillarity in soils, Permeability of soils, Darcy's law, Determination of permeability of soils, Permeability of stratified soils, Absolute coefficient of permeability, Factors affecting permeability- Effective stress principle- Effective stress under different field conditions. Seepage pressure-Quick sand condition. Seepage and Flownets (seepage velocity, exit gradient, uplift pressure), Seepage flow through earth dams, Piping failure.		
<b>Compaction of Soils</b>			
	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.		
<b>Stress distribution in Soils</b>			
	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.		
<b>Consolidation</b>			
	Types of compressibility and consolidation, Primary consolidation and secondary consolidation – Stress history of clay, normally		

	consolidated soil, over consolidated soil and under consolidated soil- pre consolidation pressure and its determination- Estimation of consolidation settlements -Terzaghi's 1-D consolidation theory – Coefficient of consolidation and its determination using consolidometer.		
<b>Shear Strength</b>			
	Definition and use of shear strength - Source of shear strength- Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory- Measurement of shear strength, Drainage conditions -Direct shear test, Triaxial shear test, Unconfined compression test and vane shear test – Factors affecting shear strength of granular soils and cohesive soils.		
<b>Slope Stability</b>			
	Types of slopes – Types of slope failures – Slip circle Method--Method of slices, Bishop's method(original and simplified), Morgenstern method, Spencer method, Determination of centre of most critical slip circle – Taylor's stability charts and their use. Stabilization of soil slopes.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEP1506 GEOTECHNICAL LABORATORY

### 1. Course Description:

The Lab sessions would include experiments on different tests on soils to find out its properties.

### 2. Learning Outcome:

On completion of the course, the students will be able to:



- Determine index properties of soils.
- Classify soils.
- Determine engineering properties of soils.

### 3. Broad Course Outline:

- Sieve analysis
- Consistency limits.
- Specific gravity.
- Permeability tests
- Unconfined compression test
- SPT test
- Direct shear test
- Core cutter and sand replacement
- Compaction test
- California bearing ratio test
- Vane shear test
- Triaxial test
- Consolidation test
- Plate load test

## CEP1507 ENVIRONMENTAL LABORATORY

### 1. Course Description:

The Lab sessions would include experiments on:

- Physical properties of water
- Chemical properties of water
- Break point chlorination test
- Determination of residual chlorine
- Determination of dissolved oxygen
- Determination of COD, BOD
- Jar test
- Total solids, Total dissolved solids and Settleable solids

### 2. Learning Outcome:

On completion of the course, the students will be able to:

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

### 3. Broad Course Outline:

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

## CEL1615 DESIGN OF STEEL STRUCTURES

### 1. Course Description

Design of Steel Structures introduces you to the design guidelines followed by engineers and designers for building or designing steel structures. The main objective of the course is to learn to use IS 800:2007 code of practice for the design of different structural elements such as compression, tension and flexural members. It introduces you to different design philosophies used in design. The course also gives an idea of different types of connections used in steel structures.

### 2. Learning Outcome

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

- apply the IS code of practice for the design of steel structural elements
- design compression and tension members using simple and built-up sections
- calculate forces on various members of truss and design them
- Analyze and design welded and bolted connections.
- design welded connections for both axial and eccentric forces

### 3. Broad Course Outline

- Introduction
- Methods of Structural Design
- Design of Steel Connections
- Design of tension Members

- Design of Compression Members
- Design of Beams
- Design of Beam Columns
- Design of Column Splices and Column Base
- Design of Eccentric Connections
- Design of Plate Girder

#### 4. Readings

- Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi 2008.
- L. S. Negi, Design of Steel Structures, Tata McGraw Hill, 2008.
- S. S. Bhavikatti, Design of Steel Structures, I. K. International Pvt. Ltd., 2009.
- S K Duggal, Design of Steel Structures, Tata McGraw Hill Education, 2000.

#### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Introduction</b>			
	General, Types of Steel, Properties of steel, Structural steel sections.		
<b>Methods of Structural Design</b>			
	Introduction, Design Philosophies, Working Stress method, Ultimate Stress method, Load and Resistant factor, Limit State Method, Partial safety factor, Load, Load combinations, General aspects in the design.		
<b>Introduction to Plastic Analysis</b>			
	Introduction to plastic theory, Plastic moment, Plastic section modulus, Plastic hinge concept, Cross section classification.		
<b>Design of Steel Connections</b>			
	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.		
<b>Design of Tension Members</b>			
	Modes of Failure of Tension member, Analysis of Tension members, Example, Design steps, Design examples, Lug angles.		
<b>Design of Compression Members</b>			
	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.		
<b>Design of Beams</b>			

	General, Lateral Stability of Beams, Bending Strength of Beams, Plastic Section Modulus, Design Examples.		
<b>Design of Beam Columns</b>			
	Behavior of members under combined loading, Modes of Failures, Design Examples.		
<b>Design of Column Splices and Column Base</b>			
	Design of Column Splice-Design Examples- Design of Column Base- Slab Base- Gusseted Base- Design Examples.		
<b>Design of Eccentric Connections</b>			
	Design of Brackets- Type-1 and Type 2 – Moment Resistant connections - Design Examples.		
<b>Design of Plate Girder</b>			
	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.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1616 STRUCTURAL ANALYSIS - II

### 1. Course Description

The course is designed to understand the classical methods of analysis of framed structures for external loads. It also highlights the approximate methods of analysis. Analysis of multistory frames for lateral load is discussed in the course. It also focuses on Matrix method of structural analysis.

### 2. Learning Outcome

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

- apply the displacement method of analysis

- apply the approximate method of analysis
- analyze structures for lateral loads
- analyze indeterminate structures using matrix method of analysis

### 3. Broad Course Outline

- Classical method of analysis of framed structures
- Approximate methods of analysis
- Lateral load analysis
- Matrix Methods of Structural Analysis

### 4. Readings

- Hibbeler. R. C, Structural Analysis, Pearson Prentice Hall, 2012.
- L.S. Negi, Theory and Problems in Structural Analysis, Tata McGraw Hill Pub, 2008.
- Wang C.K., Intermediate Structural Analysis, Tata Mc Graw Hill Publishers, 2010.
- W. Weaver and J. M. Gere, Matrix analysis of framed structures, CBS Publishers, 2nd edition, 2004.

### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Classical method of Analysis of Framed Structures</b>			
	Slope deflection method, Moment distribution method, effect of symmetry and anti-symmetry, sway correction		
<b>Approximate methods of Analysis</b>			
	Substitute frame methods for gravity load		
<b>Lateral load analysis</b>			
	Portal and Cantilever methods		
<b>Matrix method of Structural Analysis</b>			
	Local and global stiffness matrices, assembly, band storage, solution of resulting simultaneous algebraic equation, boundary conditions, applications to plane and space truss, analysis of plane frame, grid and three dimensional frame		

### 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20

3	End semester examination	50
Total		100

## CEL1617 GEOTECHNICAL ENGINEERING-II

### 1. Course Description

The course will give you an explanation of the importance of earth pressure theory in designing of earth retention structures. It explains the concept of bearing capacity and how to estimate the safe bearing capacity for various foundation systems including settlement consideration. Different aspects of foundation related to shallow foundation, pile foundation and well foundation are also discussed. It also emphasizes the importance of soil investigations including destructive and nondestructive methods. Foundations in difficult conditions are introduced such as footings resting on slope, expansive and collapsible soils. A preliminary idea of soil improvement, geosynthetic engineering and reinforced soil structure is provided.

### 2. Learning Outcome

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

- Carry out soil investigation for any civil engineering construction
- Analyze earth retaining structures for any kind of soil medium
- Estimate bearing capacity
- Design proper foundations for any kind of shallow foundation system
- Estimate pile and pile group capacity for any kind of soil including group efficiency and negative skin friction

### 3. Broad Course Outline

- Soil exploration
- Lateral earth pressure
- Bearing capacity of soil
- Settlement of foundation
- Shallow foundation
- Pile foundation
- Well foundation

### 4. Readings

- a) Murthy V.N.S, Soil Mechanics and Foundation Engineering – CBS publications, Delhi, 2007.
- b) Gopal Ranjan, Rao ASR, Basic and applied soil mechanics, New age publication, Delhi, 2000.
- c) Iqbal H Khan, Geotechnical Engineering, Prentice Hall, Delhi, 2007.
- d) J.E. Bowles, Foundation Analysis and Design, McGraw Hill, 2001.

- e) B. M. Das, Principles of foundation engineering, Cengage Learning India Pvt. Ltd., New Delhi, 2013.

## 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Soil exploration</b>			
	Introduction and different methods, Direct methods, Semi-direct and Indirect methods; Sampling in soils and rocks; subsurface exploration program, Preparation of bore logs and preparation of exploration report, SPT, CPT, PLT and VST, geophysical exploration techniques		
<b>Lateral Earth Pressures</b>			
	Lateral earth pressure theory, Different types of earth pressures, Rankine's active and passive earth pressures, pressure distribution diagram for lateral earth pressures against retaining walls for different conditions in cohesion less and cohesive soils, Coulomb's active and passive earth pressure theory, Culmann's graphical construction, Problem solving, Sheet pile wall and Braced cut.		
<b>Bearing capacity of shallow foundation</b>			
	Types of shallow foundations and choice, basic requirements, Significance of these foundations. Basic Definitions, Factors affecting bearing capacity, Estimation of Bearing capacity by different methods, Analytical methods and codal provisions, Terzaghi's and Meyerhof methods and calculations, Field measures, SPT, CPT and Plate load tests, Base bearing capacity analysis		
<b>Settlement of shallow foundation</b>			
	Settlement analysis, Types of foundation settlement, Components of settlements - their estimation, Allowable settlement values, Effects, Causes and remedial measures of total and differential settlements		
<b>Pile foundations</b>			
	Classification and uses, Load carrying capacity calculations by different methods, static methods, dynamic methods, in-situ penetration tests, piles load test; Negative skin friction; under reamed pile foundations; Pile groups,		

	Necessity, Efficiency, Group capacity and settlements.		
<b>Well foundations</b>			
	Types of caissons and their construction; Different shapes of wells, component parts and forces; Estimation of bearing capacity; sinking of wells and remedial measures for tilts and shifts, Codal provisions.		
<b>Introduction to Foundations in difficult conditions</b>			
	Foundations on slopes, foundations on expansive and collapsible soil, Introduction to soil improvement, Introduction to Geosynthetic Engineering and Reinforced soil structures.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1618 TRANSPORTATION ENGINEERING – II

### 1. Course Description

Transportation Engineering-II introduces you to pavement materials and various test performed on the pavement materials. Design of pavement using different methods is discussed in detail. It also gives an idea of different types of highway construction. It emphasize the causes of pavement failure and maintenance of highways. The course also introduces you to airport engineering and docks and harbor.

### 2. Learning Outcome

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

- Test the pavement materials to be used in design
- Design pavement
- Learn different types of highway construction
- Learn how to maintain pavement after construction
- Carry out surveys for airports and harbor



### 3. Broad Course Outline

- Pavement materials and Mix design
- Design of pavements
- Highway construction
- Highway maintenance
- Introduction to Airport engineering
- Docks and harbours

### 4. Readings

- a) Kadiyali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, India, 1997.
- b) Khanna, S.K. and C.E.G. Justo Highway Engineering, Nem Chand and Bros, Roorkee, India, 2001.
- c) IRC Codes of Practices
- d) P. Chakraborty and A. Das, Principles of Transportation Engineering, Prentice Hall India
- e) C. S. Papacotas and P. D. Prevedouros, Transportation Engineering and Planning, Hall India, 2001
- f) Khanna S K and Arora M G, Airport Planning and Design, Nemchand and Bros., 1999.
- g) Oza and Oza, Dock and Harbour Engineering, Charotar Publishing House, 2013.

### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Pavement materials and Mix Design</b>			
	Sub grade soil properties, CBR test, aggregates, desirable properties, tests, bituminous materials, bitumen and tar, tests. Bituminous mixes, requirements, design, Marshall Method.		
<b>Design of Pavements</b>			
	Types of pavement structures, functions of pavement components, design factors. Design of flexible pavements, methods, GI method, CBR method, IRC method, Burmister's method. Design of rigid pavements, design considerations, wheel load stresses, temperature stresses, frictional stresses, design of joints, IRC method of rigid pavement design.		
<b>Highway construction</b>			
	Types of highway construction, construction of earth roads, gravel roads, WBM roads. Bituminous pavements, types, surface dressing, penetration macadam, built up spray grout, bitumen bound macadam, bituminous carpet, bituminous concrete. Cement concrete		

	pavements.		
<b>Highway maintenance</b>			
	Pavement failures, causes, failures in flexible pavements and rigid pavements. Maintenance of highways, routine maintenance, periodic maintenance, special repairs. Strengthening of existing pavements, evaluation, overlay design. Highway drainage, surface and sub-surface drainage.		
<b>Introduction to Airport Engineering</b>			
	Scenario in India, national and international agencies, aircraft characteristics, site selection, airport obstructions, runway orientation, geometric design of runway, taxiway, exit taxiway, apron, holding apron, runway configuration, visual aids.		
<b>Docks and Harbours</b>			
	Types, Layout and planning principles, breakwaters, docks, wharves and quays, Transit sheds, warehouses, navigation aids.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1619 ENVIRONMENTAL ENGINEERING – II

### 1. Course Description

This course is designed to give you basics of sewage composition and its characteristics. It will give you a concept of sewers and its design. Primary and secondary treatment of sewage and the various stages of it are discussed here. The course will also introduce you to Solid waste and its disposal. The causes and effects of air pollution and noise pollution will also be emphasized at the end of the course.

### 2. Learning Outcome

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

- Determine sewage characteristics and design various sewage treatment plants

- Carry out municipal water and wastewater treatment system design and operation
- Manage hazardous wastes, risk assessment and treatment technologies
- Point out causes of air pollution and devise measures to control it
- Point out causes of noise pollution and devise measures to control it
- Carry out solid waste management

### 3. Broad Course Outline

- Introduction to Sanitary engineering
- Waste water flow estimation
- Sewage
- Treatment of sewage
- Hazardous waste and its disposal
- Solid waste management
- Air pollution-causes and effects
- Noise pollution-causes and effects

### 4. Readings

- Peavy H. S., Rowe D. R. and George Tchobanoglous, Environmental Engineering, McGraw-Hill International
- McGhee T. J, Water Supply and Sewerage, McGraw-Hill Inc.
- Metcalf and Eddy, Waste Water Engineering, Collection, Treatment and Disposal, Tata McGraw Hill Inc, New York, 2005.
- G. S. Birdie, J. S. Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, 1996.

### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Sanitary Engineering</b>			
	Important terms, sewage treatment system and waste water management.		
<b>Waste water flow estimation</b>			
	Dry Weather Flow and Storm Water, Variation of flow, Estimation of design discharge.		
<b>Sewage</b>			
	Quality and quantity perspectives of sewage, Collection and Conveyance of Sewage Conservancy and sewage carriage system, comparison, Design of Sewer, factors affecting selection of materials for sewer constructions, materials for sewers, joints in sewers, shapes of sewers, maintenance, cleaning and ventilation of		

	sewers.		
<b>Treatment of sewage</b>			
	Waste Water Treatment Flow diagram of conventional sewage treatment plant, Preliminary and primary treatment of sewage- screening, grit removal basin, tanks for removal of oil and grease, sedimentation, sedimentation added with coagulation. Secondary treatment of sewage- activated sludge process, sewage filtration, miscellaneous methods such as oxidation ditch, oxidation ponds, aerated lagoons, rotating biological contractors. Treatment and disposal of sludge, on site disposal method, advanced sewage treatment, treated effluent disposal and reuse.		
<b>Toxic and Hazardous Waste</b>			
	Equalization and neutralization, biological degradation, recycle and reuse of waste effluents, treatment of industrial wastes, Dairy, Tannery, Petrochemical, Fertilizer, textiles, Pulp and paper		
<b>Solid waste, Air Pollution, Noise Pollution</b>			
	Introduction to Solid waste, solid waste management, Air pollution effects, stack emission, automobile exhaust, control devices, Noise pollution.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1620 IRRIGATION AND HYDRAULIC STRUCTURES

### 1. Course Description

This course will help you understand the basic types of irrigation, irrigation standards and crop water assessment. It studies the different aspects of design of hydraulic structures. It will also provide you knowledge on various hydraulic structures such as energy dissipaters, head and cross regulators, canal falls and structures involved in cross drainage works. A clear understanding of seepage analysis is outlined in the course. Design of different types of dams is discussed at the end of the course.

## 2. Learning Outcome

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

- Assess the irrigation needs of crops
- Design canal systems
- Select and design canal fall
- Design weirs on pervious foundation
- Design gravity dam and earth dam
- Design spillways

## 3. Broad Course Outline

- Irrigation
- Canal systems
- Surface and subsurface flow analysis in hydraulic structures
- Design of diversion head works
- Design of canal structures
- Introduction to Dam
- Spillways and energy dissipation systems

## 4. Readings

- a) Modi P.M, Irrigation Water Resources and Hydropower Engineering, Standard Publishing Company, New Delhi, 2000.
- b) S. K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2006.
- c) Arora K.L. Irrigation Water Resources Engineering, Standard Book Publishing Co., Delhi, 1996.
- d) Asawa, G.L., Irrigation and Water Resources Engineering, New Age International, 2005.
- e) C. S Murthy, Water Resources Engineering, New Age International, 2002.

## 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Irrigation</b>			
	Necessity, Types of irrigation, Methods of supplying water, Assessment of irrigation water, Consumptive use and its determination, water requirement of various crops, Duty, Delta, Base period and crop period.		
<b>Canal Systems</b>			
	Types of canals, Principles of design of stable irrigation canals, Silt theories, Tractive force		

	theory, Design of lined canal, Design of longitudinal section, canal losses.		
<b>Surface and Subsurface Flow Analysis</b>			
	Hydraulic structures on permeable foundations, Seepage theories, Principles of design of hydraulic structures on permeable foundation, Principles of energy dissipation.		
<b>Design of Diversion Headworks</b>			
	Types of hydraulic structures, Layout of a diversion head work, Design of vertical drop weir, Design of sloping glacis weir.		
<b>Design of Canal Structures</b>			
	Canal regulators, Types of canal falls, Design of Sarda type fall, Design of straight glacis fall, Types of cross drainage works, Design of canal fluming, Design of aqueduct/ syphon aqueduct.		
<b>Introduction to Dam</b>			
	Types of Dam, Details of Arch dam. Gravity Dam and Earthen Dam		
<b>Spillways and energy dissipation systems</b>			
	Types of spillways, Design of Ogee spillway, Design of stilling basins.		

## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEP1608 TRANSPORTATION LABORATORY

### 1. Course Description

The Lab sessions would include extensive experiments on

- Volume studies
- Speed studies
- Parking survey
- Test on aggregates
- Test on bitumen
- Test on bituminous mixes
- Earthwork calculation

## 2. Learning Outcome

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

- Conduct traffic studies for estimating traffic flow characteristics
- Characterize the pavement materials
- Perform quality control test on pavements and pavement materials
- Estimate earthwork from longitudinal and cross section details
- Design grade intersections

## 3. Broad Course Outline

- Direction, duration and classification of traffic volume
- Speed studies
- Parking inventory and turnover studies and drivers characteristics
- Shape test, impact test, abrasion test, specific gravity test and water absorption test on aggregates
- Penetration test, ductility test, stripping test, softening point test, flash and fire point test, viscosity test on bitumen
- Marshall stability mix design
- Earthwork calculation

## CEL1721 ADVANCED SURVEYING

### 1. Course Description

This course will help you gain state of art knowledge about advanced survey equipments like GPS, GPR. The course will introduce you to different geodetic methods of survey such as triangulation, trigonometric leveling and modern advanced surveying techniques involved such as Remote sensing, GPS, Photogrammetry etc. It will also help understanding basics and application of GIS, Remote sensing, GPS in knowing earth topography.

### 2. Learning Outcome

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

- Understand principles of GPS.
- Understand principles of GPR.
- Understand principle of Remote sensing.
- Carry out a geodetic survey, taking accurate measurements using instruments
- Apply this advanced surveying techniques in the field of civil engineering

### 3. Broad Course Outline

- Trigonometrical surveying

- Electronic distance measurement, GPR, GPS, GIS, Remote sensing

#### 4. Readings

- T. M. Lillesand and R. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons, 1994
- G. Joseph, Fundamentals of Remote Sensing, Universities Press, 2003.
- Chandra A.M., Plane Surveying, New Age International Publishers, 2007.
- Charles D Ghilani, Paul R Wolf , Elementary Surveying, Prentice Hall, 2012.

#### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Trigonometrical surveying</b>			
	Base of the object accessible, base of an inclined object accessible, reduced level of the elevated points with inaccessible bases, instrument axes at different levels.		
<b>Electromagnetic distance measurement (EDM), GPR, GPS, Remote sensing, GIS</b>			
	Principle, Types, Photogrammetry, Terrestrial and Aerial photographs, Photo interpretation, Stereoscopy, Introduction to GPS, Segments, Principle of working, application. Introduction to Geographic Information System(GIS), Ground Penetrating Radar(GPR) and Electronic Distance measurement(EDM), Remote Sensing, Principle, Idealized remote sensing system , Types, applications.		

#### 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100



## CEL1722 ENGINEERING GEOLOGY

### 1. Course Description

Engineering Geology deals with the study of earth formation. It will introduce you to different types of minerals, crystals and rocks found in the earth. The properties of these minerals and rocks will be studied in detail in the course for engineering purpose. Phenomena's occurring inside the earth that will lead to earthquake and landslide will be introduced. The study of soil using resistivity and seismic refraction methods will also be emphasized. Dams and tunnels which require proper soil investigation for construction are also discussed at the end of the course.

### 2. Learning Outcome

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

- Identify minerals, crystals, rocks
- Know the properties of different rocks and minerals
- Know the causes and effects of earthquake and landslide
- Perform sub surface investigation
- Perform geological investigation for dams and tunnel site.

### 3. Broad Course Outline

- General geology
- Mineralogy
- Petrology
- Structural geology
- Engineering properties of rock
- Ground water
- Earthquakes and landslides
- Subsurface Investigations
- Dams
- Tunnels

### 4. Readings

- a) K.V.G.K. Gokhale, Principles of Engineering Geology, BS Publications, 2009.
- b) David George Price, "Engineering Geology: Principles and Practice", Springer, 2009.
- c) Parbin Singh., Engineering and General Geology, Katson Publishers, 2009.
- d) N. Chenna Kesavulu, "Text book of Engineering Geology", Mac Millan Ltd., New Delhi, 2009.

### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
	General Geology		

	Branches and scope of geology, Importance of geology in Civil engineering. Earth surface features and internal structure, weathering of rocks.		
<b>Mineralogy</b>			
	Definition of a crystal and mineral, physical properties in mineral identification, rock forming minerals and their identification – quartz and its varieties, feldspar, hornblende, olivine, mica, garnet, kyanite, calcite, talc, bauxite, corundum, gypsum, fluorite, apatite, beryl, barite, asbestos, magnetite, hematite.		
<b>Petrology</b>			
	Formation and classification of rocks – Igneous, Sedimentary and metamorphic rocks, their texture and structures, properties of granite, pegmatite, dolerite, gabbro, charnockite, basalt, sandstone, conglomerate, breccia, limestone, shale, laterite, schist, gneiss, quartzite, marble, khondalite and slate.		
<b>Structural Geology</b>			
	Outcrop, Strike and dip, types and classifications of folds, faults, joints, unconformities.		
<b>Engineering properties of rocks</b>			
	Drilling, Core recovery, RQD, Sample preparation, tests on rock samples - compression, tensile, shear and slake durability tests		
<b>Ground Water</b>			
	Water tables, aquifers, occurrence of ground water in different geological formations, springs, selection of a site for well sinking and ground water investigations.		
<b>Earthquakes and Landslides</b>			
	Causes and effects of earthquakes and landslides, Remedial measures to prevent damage for engineering structures.		
<b>Subsurface Investigations</b>			
	Soil Profile, Geophysical methods – Electrical Resistivity and Seismic refraction methods.		
<b>Dams</b>			
	Types of dams, Requirements of dam sites, preliminary and detailed geological investigations for a dam site, Case histories of dam failures and their causes. Geology of the major dam sites of India, Factors affecting the seepage and leakage of reservoir and the remedial measures.		
<b>Tunnels</b>			
	Purpose of tunneling, geological considerations for tunneling, geothermal step, over break, stand		

	up time, and logging of tunnels.		
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## 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## CEL1723 BUILDING PLANNING AND SUSTAINABLE CONSTRUCTION

### 1. Course Description

Building planning and construction is designed to help you understand the principles of planning of buildings and bylaws. This will give you an idea for drawing plan, elevation and section of different types of building e.g. residential building, industrial building etc. Detailed drawing for doors, windows etc. can also be worked out. The concept of damp proofing, fire protection and thermal insulation of buildings is also introduced at the end of the course.

### 2. Learning Outcome

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

- Apply the principles of planning and bylaws used for building planning
- Draw plan, elevation and section for various structures
- Apply damp proofing methods and fire protection measures in building

### 3. Broad Course Outline

- Functional planning of buildings
- Masonry
- Floors and roofs
- Doors and windows
- Damp proofing
- Fire protection
- Thermal insulation

### 4. Readings

- a) Varghese P. C. Building construction, PHI Learning Pvt. Ltd., 2008.
- b) Punmia B. C., Jain A. J. and Jain A. J. Building construction, Laxmi Publications, 2005.

- c) Arora S.P., and Bindra S.P., The text book of building construction, Dhanpat Rai Publications, 2010.
- d) National Building Code(NBC)

### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Functional Planning of buildings</b>			
	General aspects to consider for planning, bye-laws and regulations, Selection of site for building construction, Principles of planning, Orientation of building and its different elements, Components of building.		
<b>Concepts of green building</b>			
	Introduction to concept of green technology for building construction.		
<b>Floors and Roofs</b>			
	Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings.		
<b>Doors and Windows</b>			
	Location of roofs and windows, Definition of technical terms, Size of doors and windows, Door frames, Types of doors and windows, Ventilators, Fixtures and fastenings.		
<b>Damp proofing, Fire protection and Thermal insulation</b>			
	Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction, General methods of thermal insulation and thermal insulating materials.		

### 6. Evaluation plan

Sl no.	Type of evaluation	Weightage
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100

## **CEP1709 ADVANCED SURVEYING LABORATORY**

### **1. Course Description**

The Lab sessions would include extensive experiments on

- Trigonometric leveling to determine heights/elevations
- GIS and Remote Sensing application software

### **2. Learning Outcome**

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

- Apply geometric and trigonometric principles of basic surveying calculations
- Use advanced application software for GIS, Remote sensing

### **3. Broad Course Outline**

- Trigonometrical leveling
- GIS application software like ARCINFO
- Remote sensing software like ERDAS, GEOMEDIA.

## **CEP1710 GEOLOGY LABORATORY**

### **1. Course Description**

The Lab sessions would include extensive experiments on

- Identification of rocks
- Identification of crystals
- Strike and dip
- Geological map

### **2. Learning Outcome**

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

- Identify minerals and rocks
- Measure strike and dip of bedding planes
- Interpret geological maps

### **3. Broad Course Outline**

- Identification of crystals
- Introduction of minerals and study of physical properties
- Identification of pyroxenes and Amphiboles and other silicates

- Identification of important economic materials
- Identification of important ore deposits
- Identification of rocks
- Strike and dip
- Completion of out crop maps

## **CEP1711 COMPUTATIONAL LABORATORY**

### **1. Course Description**

This course will introduce students to basic software useful in civil engineering (e.g. SAP, ANSYS, PLAXIS 2D, ARC GIS, ROCKSCIENCE, etc.).

### **2. Learning Outcome**

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

- Analyze the behavior of different civil engineering structures using software
- Design civil engineering structures using software

### **3. Broad Course Outline**

- Introduction to various civil engineering software.

## **CEL1824 QUANTITY SURVEYING AND PUBLIC WORKS**

### **1. Course Description**

Quantity surveying and public works will help you understand the importance of estimates under different conditions. It will help you know about the rate analysis and bill preparations. The course emphasizes the idea of specification writing. It will also help you understand the valuation of land and buildings.

### **2. Learning Outcome**

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

- Apply different types of estimates
- Carry out analysis of rates and bill preparation
- Demonstrate the concept of specification writing
- Handle contracts and tender
- Carry out valuation of assets

### **3. Broad Course Outline**

- Introduction to estimates

- Analysis of rates
- Specifications
- Contracts
- Tenders
- Valuation

#### 4. Readings

- M. Chakraborti, Estimation, costing, specifications and valuation in civil engineering, National Half-tone Co. Calcutta, 2005.
- Rangawala, Estimating, Costing and Valuation, Charotar Publishing House Pvt. Ltd., 2014.
- B. N. Dutta, Estimation and costing in civil engineering: theory and practice, UBS Publishers Distributors Ltd, 2006.
- G. S. Birdie, Estimation and costing in civil engineering, Dhanpat Rai Publishing Co. Ltd.

#### 5. Session Plan

No of Sessions	Topics covered	Readings	Date
<b>Introduction to estimates</b>			
	Purpose of estimating; Different types of estimates - their function and preparation; Building estimates: Schedule of rates, Units of measurements, units of works; Road Estimates – Volume of earthwork, Different methods, Earthwork for hill roads; Railway and canal works – Estimates for a new track railway line; earthwork in canals.		
<b>Analysis of rates</b>			
	Preparation for analysis of rates. Quantity of materials per unit rate of work, labour estimate.		
<b>Specifications</b>			
	Necessity, types of specifications, specifications for different civil engineering materials.		
<b>Contracts</b>			
	Essentials of contracts, types of engineering contracts – advantages and disadvantages.		
<b>Valuation</b>			
	Purpose, difference between value and cost, qualifications and functions of a valuer, scrap & salvage value, sinking fund, capitalized value.		

**6. Evaluation plan**

<b>Sl no.</b>	<b>Type of evaluation</b>	<b>Weightage</b>
1	Mid semester examination	30
2	Internal evaluation	20
3	End semester examination	50
Total		100