

Bachelor of Technology in Civil Engineering (with Specialization)

Department of Civil and Environmental Engineering (2019-20)

Semester										Lecture Courses	L	T	P	Contact hours per week	Credits
I	MAL151 Engineering Mathematics I 3-0-2(4)	PYL150 Engineering Physics 3-0-2(4)	ECL110 Basics of Electrical and Environmental Engineering 3-0-2(3)	MEL150 Basics of Mechanical Engineering 2-0-2(2.5)	CSL106 FOCP-1 2-0-6(5)	CLL101 Effective Communication I 1-0-2(2)			CER101 General Proficiency (1)	6	13	0	12	25	21.5
II	MAL152 Engineering Mathematics II 3-0-2(4)	CSL108 FOCP-II 2-0-6(5)	CLL 120 Human Values and professional Ethics 1-0-1 (1.5)	MEP110 Engineering Graphics & Drawing 1-0-3(2.5)	CHL150 Engineering Chemistry 1-0-3 (2.5)	CLL102 Effective Communication II 2-0-0(2)	CSL110 Problem Solving and design thinking 0-0-4(2)		CER102 General Proficiency (1)	6	12	0	13	25	20.5
CET102 Summer Camp (2 weeks)															
III	CEL 201 Mechanics of Solids 3-1-0(4)	CEL203 Fluid Mechanics 3-0-2(4)	CEL205 Surveying 3-0-2(4)	CEL210 Concrete Technology 3-0-0 (3)	CEL215 Building materials and construction 3-0-0(3)	CHL100 Environmental Studies 3-0-0(3)			CER201 General Proficiency (1)	6	18	1	4	23	22
IV	CEL202 Structural Analysis-I 3-1-0(4)	CEL206 Environmental Engineering 3-0-2(4)	CEL212 Transportation Engineering 3-0-0(3)	CEL214 Design of Concrete Structures 3-1-0 (4)	PE-1 (3)	CEP202 Material Testing Lab 0-0-4 (2)		Value Addition Course (1)	CER202 General Proficiency (1)	5	15	2	6	23	22
Summer	CET212 Survey Camp with Software application (2 weeks) + Practical Training/Software (4 weeks)														02
V	CEL301 Structural Analysis II 3-1-0(4)	CEL311 Soil Mechanics 3-0-2(4)	CEL315 Design of Steel Structures 3-1-0(4)	OE-1 (3)	OE-2 (Foreign Language) (3)	CEP302 Computer Aided Design and Drawing 0-0-2(1)			CER301 General Proficiency (1)	5	15	2	4	21	20
VI	CEL318 Earthquake Resistant Design of Structures 3-1-0 (4)	CEL303 Water Resource Engineering 3-0-0(3)	CEL222 Construction Management 3-0-0(3)	PE 2 (3)	OE-3 (3)	CLP 300 Campus to Corporate 0-0-2(1)	CEP 304 Technical Skills 0-0-2(1)	CEP306 Project Based Learning (Tinkering) (1)	CER302 General Proficiency (1)	5	15	1	4	20	20
Summer	CET 330 Practical Training-II @ construction site (8-10 weeks)														03
VII	PE 3 (3)	PE 4 (3)	PE 5 (3)	SML300 Entrepreneurship (3)	OE-4 (3)		CED304 Major Project(A) 0-0-8(4)	Value Addition Course (1)	CER401 General Proficiency (1)	5	15	0	8	23	21
VIII	*PE 6 (3)	*PE 7 (3)					CED405 Major Project (B) / Pre-Placement Internship 0-0-12(6)	SEG400 Self-Study Course GATE (Audit)	CER402 General Proficiency (1)	2	6	0	12	18	13
TOTAL															167
*Blended course(s) equivalent to 6 credits will be offered as MOOCs on platforms like SWAYAM, Coursera, NPTEL, edX etc. with 1 facilitation hour by internal faculty															
				<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="margin: 0;"> University Level Courses</p> <p style="margin: 0;"> Theory Courses</p> <p style="margin: 0;"> Lab Courses</p> <p style="margin: 0;"> Program Elective Courses</p> </div> <div style="width: 45%;"> <p style="margin: 0;"> General Proficiency</p> <p style="margin: 0;"> Open Elective courses</p> <p style="margin: 0;"> Project based Learning</p> <p style="margin: 0;"> Skill Development Courses</p> </div> </div>											

Specialization	Set of Program Electives for Specialization						
	Semester IV	Semester VI	Semester VII	Semester VII	Semester VII	Semester VIII	Semester VIII
	PE-1	PE-2	PE-3	PE-4	PE-5	PE-6	PE-7
Smart Infrastructure Development	Estimation & Costing in Civil Engineering	Urban Town Planning	Green Building	Smart Materials & Composites	Smart Transportation Systems	Smart Waste Management/ MOOC*	MOOC*
Construction and Project Management	Estimation & Costing in Civil Engineering	Urban Town Planning	Quality & Safety in Construction	Construction Economics & Finance	Construction Practices	Advanced Methods of Management Research/ MOOC*	MOOC*

*MOOC course relevant to the specialization

About Specialization:

- In this program there are following options available with the student:
 - Either he/she can opt for B.Tech in Civil Engineering
 - OR he/she can opt for B.Tech in Civil Engineering (with specialization)
- If a student wants to opt for B.Tech in Civil Engineering (with specialization) then the areas of specialization are as follows:
 - Smart Infrastructure Development
 - Construction & Project Management
- As per the scheme, if the student is not willing to go for any specialization, he/she is allowed to take program electives (7 PE courses from IVth Semester to VIIIth Semester) from the list of PEs given in the scheme and he/she can do final year Major Project in any field pertaining to Civil Engineering.
- If a student is willing to go for a specializations offered by the department, then he/she will have to take elective courses mandatory for that respective specialization and have to do his/her Major Project in the area of their chosen specialization.
- For students who opt for B.Tech in Civil Engineering (with specialization), a separate certificate of specialization after completion of the program will be issued along with the degree of B.Tech in Civil Engineering.
- The minimum and maximum number of students in each elective shall be 20 and 60 respectively.

Scheme of Studies (B.Tech) Programme Code: CE
Bachelor of Technology in Civil Engineering (2018-19)

Undergraduate Course Categories			
Category	Credits	Category	Credits
Basic Sciences (BS)	21	SPT	18
ES & TA	21	GP	08
HMS Core	09	Program Electives (PE)	21
Program Core (C)	53	Open Electives (OE)	15
Total Credits			167

Basic Sciences (BS) Core		L	T	P	C
MAL151	Engineering Mathematics I	3	0	2	4
MAL152	Engineering Mathematics II	3	0	2	4
PYL150	Engineering Physics	3	0	2	4
CHL150	Engineering Chemistry	2	0	2	3
CHL100	Environmental Studies	3	0	0	3
Engineering Sciences and Technical Arts (ES & TA) Core					
CSL106	FOCP-I	1	0	2	2
CSL108	FOCP-II	1	0	2	2
MEL150	Basics of Mechanical Engineering	2	0	2	3
MEP110	Engineering Graphics and Drawing	1	0	3	3
ECL 110	BEEE	3	0	2	4
CSL110	Problem Solving and design thinking	2	0	2	3
CEP302	Computer Aided Design and Drawing	0	0	2	1
Humanities and Management Sciences					
CLL101	Effective Communications I	1	0	2	2
CLL102	Effective Communications II	1	0	2	2
CLL120	Human Value & Professional Ethics	2	0	0	2
CLP 300	Campus to Corporate	0	0	2	1
SML300	Entrepreneurship	3	0	0	3
GP					
CERxxx	General Proficiency	-	-	-	8
Programme Core PC					
CEL201	Mechanics of solids	3	1	0	4
CEL202	Structural Analysis -I	3	1	0	4
CEL203	Fluid mechanics	3	0	2	4
CEL205	Surveying	3	0	2	4
CEL206	Environmental Engineering	3	0	2	4
CEL210	Concrete Technology	3	0	0	3
CEL212	Transportation Engineering	3	0	0	3
CEL214	Design of Concrete Structures	3	1	0	4
CEL215	Building Materials and Construction	3	0	0	3
CEL222	Construction Management	3	0	0	3
CEL301	Structural Analysis II	3	0	2	4
CEL303	Water Resource Engineering	3	0	0	3
CEL311	Soil Mechanics	3	0	2	4
CEL315	Design of Steel Structures	3	1	0	4
CEL318	Earthquake Resistant Design of Structures	3	1	0	4
CEP202	Material Testing Lab	0	0	4	2
CEP304	Technical Skills	0	0	2	1
SPT					
CET102	Summer Camp	0	0	4	2
CET212	Survey Camp with Software application + Practical Training	-	-	-	2
CET330	Practical Training II at Const. Site	-	-	-	3
CED403	Major Project (A)	0	0	8	4
CED404	Major Project (B)	0	0	12	6
SEG400	Self-Study course GATE	-	-	-	0
CEP306	Project Based Learning (Tinkering)	-	-	-	1
Programme Electives					
IV semester PE-1					
CEL216	Air Pollution and Control	3	0	0	3
CEL218	Open Channel Flow	2	1	0	3
CEL222	Estimation and Costing in Civil Engineering	2	0	2	3
	Selected Topics	-	-	-	3
VI semester PE-2					
CEL302	Foundation Engineering	2	1	0	3
CEL304	Solid Waste Management	3	0	0	3
CEL316	Railways, Harbors, Docks & Airports	2	1	0	3
CEL318	Urban Town Planning	3	0	0	3
	Selected Topics	-	-	-	3

VII semester PE-3					
CEL424	Advanced Design of Steel Structures	2	1	0	3
CEL426	Construction Practices	3	0	0	3
CEL436	Ground water Hydrology	3	0	0	3
CEL438	Atmospheric Diffusion & Air Pollution	3	0	0	3
CEL440	Green Buildings	3	0	0	3
CEL442	Quality & Safety in Construction	3	0	0	3
	Selected Topics	-	-	-	3
VII semester PE-4					
CEL411	Advanced Design of Concrete Structures	2	1	0	3
CEL413	Water Power Engineering	3	0	0	3
CEL415	Transportation Economics, Planning and Management	2	1	0	3
CEL417	Geotechnical Investigation & Instrumentation	3	0	0	3
CEL419	Remote Sensing & GIS	3	0	0	3
CEL434	Design of Hydraulic Structures	2	1	0	3
CEL452	Smart Materials & Composites	3	0	0	3
CEL422	Construction Economics and Finance	3	0	0	3
	Selected Topics	-	-	-	3
VII semester PE-5					
CEL423	Design of Tall Structures	2	1	0	3
CEL425	Structural Safety & Reliability	2	1	0	3
CEL427	Repair and Rehabilitation of RCC Structures	3	0	0	3
CEL454	Smart Transportation Systems	3	0	0	3
CEL426	Construction Practices	3	0	0	3
CEL448	Ground Improvement Techniques	3	0	0	3
	Selected Topics	-	-	-	3
VIII semester PE-6					
CEL431	Climate Change Sustainability	3	0	0	3
CEL433	Prefabricated Structures	3	0	0	3
CEL435	Matrix Method of Structure analysis	2	1	0	3
CEL437	Pre-Stressed Concrete Structures	2	1	0	3
CEL453	Smart Waste Management	3	0	0	3
CEL456	Advanced Methods of Management Research	3	0	0	3
CEL432	Finite Element Analysis	2	1	0	3
	MOOC	-	-	-	3
	Selected Topics	-	-	-	3
VIII semester PE-7					
CEL441	Bridge Engineering	2	1	0	3
CEL443	Environmental Policy, Legislation and Economics	3	0	0	3
CEL445	Geosynthetics and Reinforced Soil Structures	2	1	0	3
CEL442	Smart Structures	3	0	0	3
CEL444	Environmental Impact Assessment	3	0	0	3
CEL402	Disaster Management	3	0	0	3
	MOOC	-	-	-	3
	Selected Topics	-	-	-	3

Bachelor of Technology in Civil Engineering

Department of Civil and Environmental Engineering

CEL201 Mechanics of Solids

4 Credits (3-1-0)

Stress and Strain- Hooke's law, elastic constants, principal stresses, Mohr's circle; shear center in brief; Beams- bending moment and shear force, Theory of simple bending, bending and shear stresses, combined stresses; Columns-Euler's and Rankine's formula; Torsion- shafts and closed thin walled sections; Thin and thick cylindrical shells- stresses;

CEL203 Fluid Mechanics

4 Credits (3-0-2)

Introduction; Dimensions and units; Fluid properties; Fluid Statics- Fluid kinematics - Fluid dynamics- Flow through pipes Dimensional analysis and similitude- Boundary layer analysis-Field applications-

CEL205 Surveying

4 Credits (3-0-2)

Introduction to Surveying; Measurement of linear distances. Leveling, Theodolite and theodolite traversing- Plane Table Surveying, Tacheometry, Curves, Triangulation, Trigonometry, Errors in measurement and their adjustments; Introduction to astronomical surveying; Introduction to E.D.M. instruments, Total station, use of surveying instruments for marking the layout of civil engineering structures.

Laboratory: Measurement of linear distances, bearings and angles using compass, level surveying for determination of reduced levels and for contour surveying, plane table surveying, measurement of horizontal and vertical angles using theodolite, tacheometry, simple curve setting, triangulation surveying, use of total station for measuring distances and angles.

CEL210 Concrete Technology

3 Credits(3-0-0)

Concrete materials- types, characteristics, quality and tests on cement, Aggregates and water; Concrete - mix design by IS and ACI methods,, manufacture of concrete, workability, segregation, bleeding, batching, mixing, transportation, compaction and curing of concrete; Elastic properties of Concrete-Strength of concrete, creep, shrinkage and durability; admixtures in concrete; Special concrete-Special aggregates: light weight – artificial – natural – special concrete – no – fine concrete- high density concrete – Sulphur infiltrated concrete – fibre reinforced concrete – polymer concrete polymer impregnated concrete – polymer cement concrete, special concreting methods like cold Weather concreting, hot weather concreting

CEL208 Building Materials and Construction

3 Credits (3-0-0)

Composition, characteristics and uses of construction materials- cement, brick, stone, tile, soil, wood, glass, paint, concrete, steel, aluminium etc. Walls- Floors- Roofs- Footings and simple foundations for simple residential and framed buildings ; Damp proof and weathering courses; doors and windows; Building services- acoustics, ventilation, lighting, fire protection, plumbing,; energy efficient and

intelligent buildings; brief introduction to methods used in concrete and steel construction and construction equipment- use of composite materials in construction - Professional Practice.

CET102 Summer Camp

2 Credits (0-0-0)

Summer Camp is organized to focus on fostering a strong sense of ethical judgment and moral fortitude. It provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative activities

CEL202 Structural Analysis I

4 Credits (3-1-0)

Analysis of statically determinate structures, Deflection of Beams, Strain energy method; Rolling loads and influence lines; Unsymmetrical bending, use of software in the analysis

CEL206 Environmental Engineering

4 Credits (3-0-2)

Water supply-Water quantity, Sources, Water demands, Intakes, Water pipe network analysis and design, Water Quality, Water Treatment – Processes and design. Sewage-Importance, Collection, Quantity, Quality, Sewage treatment- Processes and design. Software Application

Laboratory: Sampling and analysis of water for pH, hardness, conductivity, DO, other impurities- sampling and analysis of waste water for pH, hardness, conductivity, DO, BOD,COD and other impurities.

CEL212 Transportation Engineering

3 Credits (3-0-0)

Introduction- Historical Developments, Road Development Plans, Highway Design- Highway Planning, Geometric Design of Highways, Pavement Analysis & Design- Types & Component parts of Pavements, Pavement Materials, Pavement Design considerations, Highway Traffic Analysis & Design- Elements of Traffic Engineering, Vehicle & roadway driver characteristics, Intelligent Transport Systems- Traffic Simulation, Rapid Transit System in urban areas, Transportation Systems- Introduction to railway engineering, airport engineering, Introduction to docks and harbours.

CEL214 Design of Concrete Structures

4 Credits (3-1-0)

Design basis for reinforced concrete structures- working stress and limit state design principles, Slab design- one way, two way and continuous slab; Beam design- singly and doubly reinforced, rectangular, T and L shaped beams; Columns- short and long columns concentric and eccentric loading, Framed structure-Software applications. Detailed drawing of beam, column and slabs

CEP202 Material Testing Lab

2 Credits (0-0-4)

Fineness, specific gravity, normal consistency, setting times, workability, soundness of cement, , bulking of sand, fineness modulus of fine and coarse aggregate, impact strength, Los-

Angel's and Dorry's abrasion, Deval attrition, crushing strength of aggregates, compressive strength of cement mortar, Compressive strength of cement concrete, split tensile strength of concrete, Bending test on concrete beam, non-destructive test of concrete, compressive strength of brick, and determination of penetration, ductility, viscosity, softening point, flash and fire point for bitumen, CBR test.

CEL216 Air Pollution and Control

3 Credits (3-0-0)

Sources and types of air pollution, Dispersion of air pollutants into the atmosphere, air quality modelling, Engineering device to control particulate matter and gaseous pollutants, Sources, effects and status of indoor air pollution.

CEL218 Open Channel Flow

3 Credits (2-1-0)

types of channels, velocity and pressure distribution, energy and momentum equation, transition channels, uniform and gradually varied flow in open channels, rapidly varied flow, hydraulic jump, hydraulics of mobile bed.

CEL220 Green Building

3 Credits (3-0-0)

Background terms; Smart Growth, smart city and New Urbanism and the Resistance to Change; Green Building Assessment; Green Building Index; Life Cycle Costing; The Setting/Green Roofs, Case Study; Energy and Buildings; Energy And Hydrologic Systems; Materials/Specifications; Interior Environments (lighting, air), GRIHA, LEEDs rating system, BEE Standards and guidelines.

CEL220 Construction Management

3 Credits (3-0-0)

Introduction- importance of construction management, role of government, public and private sector; construction economics and finance-tender and contract- network techniques -quality and safety in construction; Professional Practice. Software Application

CEL222 Estimation and Costing in Civil Engineering

3 Credits (2-0-2)

Introduction – types of estimate – approximate estimate – method of estimate of quantities for buildings – brief idea for estimate of quantities for roads, water supply etc. – analysis of rates – specifications – preparation of detailed estimate for buildings – valuation of buildings –different methods of valuations, use of MS excel for estimation.

CEL301 Structure Analysis-II

4 Credits (3-0-2)

Analysis of statically indeterminate structures, force method, concept of kinematic indeterminacy, development of slope deflection equation, theorem of three moments, influence lines using Muller Breslau principle, moment distribution method and application to beams and simple frames.

CEL303 Water Resource Engineering

3 Credits (3-0-0)

Introduction, Precipitation, Runoff, Hydrographs, Groundwater, Irrigation Engineering

CEL311 Soil Mechanics

4 Credits (3-0-2)

Soil formation and composition, definitions and terms, basic soil properties, soil classification, soil structure, clay minerals; Permeability, Seepage; Principle of effective stress; Stress distribution; Consolidation; Compaction; Shear strength

Laboratory: Textural Classification, Specific gravity, moisture content determination, grain size distribution, Atterberg limits (Liquid, plastic and shrinkage), field density, permeability, Proctor's compaction.

CEL315 Design of Steel Structures

4 Credits (3-1-0)

Basics of design of steel structures-working stress and plastic design; Connections- bolted, riveted and welded connections; Members-tension and compression members-Beams and Columns including built up sections, column bases- Types, connections and supports; Introduction to Software applications; Drawing of: Connections, beams, columns, column bases.

CEL318 Earthquake Resistant Design of Structures

4 Credits (3-1-0)

Characteristics of earthquake, measurement of earthquake, dynamics of single degree of freedom system, earthquake response to single degree of freedom system, response spectrum, earthquake resistant designing concepts, response reduction factor, stiffness and building configuration, lateral loads, IS 1893 provisions for buildings, active and passive vibration control, dampers

CEP302 Computer Aided Design and Drawing

1 Credit (0-0-2)

2D multi-view drawing of a simple objects, Floor Plan of residential buildings and its components like foundations, Staircases, Continuous Beams, Slabs, Reinforcement detailing in the members. 3D isometric drawing of various components.

CEL302 Foundation Engineering

3 Credits (2-1-0)

Foundations- Design considerations, introductory concepts, bearing capacity; Shallow foundations - design considerations, types; Deep foundations-pile foundations, caissons and cofferdams; Stability of slopes; Basics of machine foundations; Site investigations and subsoil explorations; Ground improvement and Professional practice. Software Application. Laboratory: Hydrometer analysis, unconfined compression test, direct shear test, consolidation test and Tri-axial shear test, SPT, SCPT, DCPT, Flownet Construction, Plaxis- Estimation of settlement, Flow through an embankment.

CEL304 Solid Waste Management

3 Credits (3-0-0)

Definition, sources and types of solid waste, Biomedical & Hazardous waste, Waste from industrial and commercial

activities, Radioactive waste, legislations on management and handling of different solid waste, Monitoring & Responsibilities. Collection to treatment, Materials Recovery, Waste transformation, transport means and methods, Landfills, Integrated waste management facilities, Sampling and characterization, TCLP, Health and safety issues, Environmental issues.

CEL316 Railways, Harbors, Docks and Airports

3 Credits (2-1-0)

Railway engineering- gauges, track components, signaling system; Airport engineering- airport configuration, runways, taxiways, aprons, terminal area, lighting, marking; air traffic control; Docks & Harbour engineering.

CEL318 Urban Town Planning

3 Credits (3-0-0)

Origin and Growth of Town, Purpose, Type, Data Required; Elements of City Planning. Circulation Pattern, Landscape Pattern of Building; Use of Master Plan. Central Areas: Town centre, Civil Spaces, Shopping Centre, Neighborhood Units, Layout with Houses, Building Bye-Laws. Priorities, Classifications, Siting Industrial Estate. Slum Clearance Scheme, Town Planning Schemes, Satellite Town, Control of Ribbon Development.

CET212 Survey Camp with Software Application

2 credits (0-0-0)

Hands on exercise with Theodolite, cross staff, levelling staff, tapes, plane table and total station. The camp must involve work on a large area. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

CEL422 Construction Economics and Finance

3 Credits (3-0-0)

Benefit-cost analysis, Replacement analysis, Break even analysis. Risks and uncertainties and management decision in capital budgeting. Taxation and inflation. Work pricing. Working capital management, financial plan and multiple source of finance. International finance, Budgeting and budgetary control, Practical problems and case studies, Project cash flow, Methods, Practice, Role of Lender's Engineer. Financial Planning, Budget –Budgetary control system.

CEL424 Advanced Design of Steel Structures

3 Credits (2-1-0)

Elementary Plastic Analysis and Design, Industrial Buildings, Design of Water Tanks, Stacks and Towers.

CEL426 Construction Practices

3 Credits (3-0-0)

Introduction – planning of new project, site access and services, earth excavation and Earth moving equipment, excavation in hard rock; RMC plant, layout and production capacity. Grouting, Shotcreting, under water concreting. Slip formwork; Prefabricated construction: Relative economy, Steel construction: Planning and field operations, Erection equipment's Floating and dredging equipment; Asphalt

mixing and batching plant (Hot mix plant), Sensor Paver for rigid roads, Crushing plants, Belt conveyers, cableways.

CED304 Major Project (A)

4 Credits (0-0-8)

B.Tech Major Project is to demonstrate a depth of knowledge of Civil and Environmental Engineering. Students are required to conduct independent work resulting in at least a thesis publication at the end.

CET330 Practical Training II

3 credits (0-0-0)

Practical training in an industry or R&D Organization during summer vacation to have hands on experience exposure to industrial and research environment.

CEL411 Advanced Design of Concrete Structures

3 Credits (2-0-2)

Stair case, Simple and combined footings; Design of retaining structures- water tanks, silos, bunkers, retaining walls

CEL413 Water Power Engineering

3 Credits (2-0-2)

Water power development; Types of plants; plant lay out; Small hydro power; penstocks, water hammer, surge tanks; intakes; reservoir operation in multipurpose projects.

CEL415 Transportation Economics, Planning and Management

3 Credits (2-0-2)

Public transport in Urban Areas, Public Transportation Planning Methodology, Public Transportation Management System, alternate public transportation system, Motor Vehicles Act- Statutory provisions for road Transport, Elasticity of demand, Economic Analysis of projects- Methods of Evaluation, Cost-Benefit Ratio, and Financing of Road Project- Methods.

CEL417 Geotechnical Investigation & Instrumentation

3 Credits (2-0-2)

Phases of site investigation, Geophysical, Sounding, Drilling and Accessible explorations. Sample requirements, sampling methods and equipment. Planning & Monitoring program, Handling, preservation and transportation of samples. Methods of monitoring Laboratory tests, analysis of results and interpretation. General Guidelines for monitoring, Instrumentation applications.

CEL419 Remote Sensing & GIS

3 Credits (2-0-2)

Remote Sensing - Remote sensing and its component, Data collection and transmission, Different sensors and satellite imageries. Electromagnetic energy and spectrum, photogrammetric and aerial photography, photographic interpretation, stereographic viewing, image processing, potential applications of remote sensing in diverse areas and decision making; GIS Introduction to Geographical Information system, Data bases, and Data base management systems

CEL423 Design of Tall Structures

3 Credits (2-0-2)

Design philosophy – Loading - Sequential loading, materials. High risk behavior, Rigid frames, braced frames, infilled frames, shear walls, coupled shear walls, wall – frames, tubulars, cores, futrigger - braced and hybrid mega system. Approximate Analysis, Accurate Analysis and Reduction Techniques - Analysis of building for member forces - drift and twist - Computerised general three-dimensional analysis. Structural elements- design, deflection, cracking, prestressing, shear flow Design for differential movements, creep and shrinkage effects, temperature effects and fire. Overall buckling analysis of frames, wall – frames–second order effects of gravity of loading– simultaneous first order and P-delta analysis Translational - torsional instability, out of plum effects

CEL425 Structural Safety & Reliability

3 Credits (2-0-2)

Fundamentals of set theory and probability, probability distribution, regression analysis, hypothesis testing. Stochastic process and its moments and distributions, Concepts of safety factors, Safety, reliability and risk analysis, first order and second order reliability methods, simulation based methods, confidence limits and baysean revision of reliability, reliability based design, examples of reliability analysis of structures.

CEL427 Repair and Rehabilitation of RCC Structures

3 Credits (2-0-2)

Quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, materials for repair, techniques for repairing of structures

CEP401 Technical Skills

1 Credit (0-0-2)

Theoretical and practical knowledge based on industry-oriented topics shall be provided in the form of tutorials, presentation and laboratories

CED405 Major Project (B)

3 Credits (0-0-6)

B.Tech Major Project is to demonstrate a depth of knowledge of Civil and Environmental Engineering. Students are required to conduct independent work resulting in at least a thesis publication at the end.

CEL431 Climate Change Sustainability

3 Credits (2-0-2)

Water power development; Types of plants; plant lay out; Small hydro power; penstocks, water hammer, surge tanks; intakes; reservoir operation in multipurpose projects.

CEL433 Prefabricated Structures

3 Credits (2-0-2)

Types of prefabrication, prefabrication systems and structural schemes- Disuniting of structures- Structural behaviour of precast structures. Handling and erection stresses - Application of prestressing of roof members; floor systems two-way load bearing slabs, Wall panels, hipped plate and shell structures. Dimensioning and detailing of

joints for different structural connections; construction and expansion joints. Production, Transportation & erection-Shuttering and mould design Dimensional tolerances-Erection of R.C. Structures, Total prefabricated buildings. Designing and detailing prefabricated units for 1) industrial structures 2) Multistory buildings and 3) Water tanks, silos bunkers etc. 4) Application of prestressed concrete in prefabrication

CEL435 Matrix Method of Structure analysis

3 Credits (2-0-2)

General Introduction. A Few Historical Remarks. Matrix Methods of Analysis of Skeletal Structures. Methods of Analysis. Displacement Method: Stiffness Relationships. The Matrix Displacement Approach, Introduction, Stiffness Matrix of a Bar Element subjected to Axial Force. Co-ordinate Transformations. Global Stiffness Matrix. Application to Pin-Jointed Frames. Stiffness Matrix of a Beam Element. Application to Continuous Beams. Matrix Displacement Analysis of Planar Rigid-Jointed Frames. Neglect of Axial Strain in the Analysis of Planar Rigid-Jointed Frames. Other Kinds of Loading & Other Kinds of Frames. Co-ordinate Transformations. Element Stiffness Matrix & its Application. Matrix Displacement Analysis of Three-Dimensional Structures. Co-ordinate Transformations. Application to Space Trusses & Space Frames

CEL437 Prestressed Concrete Structures

3 Credits (2-0-2)

Theory and behavior – basic concept, methods of pre stressing, loss of pre stress, Analysis of prestress, calculations of deflections , crack width; design concepts – procedures as per codes, stress distributions, limit state design criteria; design of pre stressed concrete, Analysis and design of indeterminate prestress members, tanks, pipes and composites construction and elementary idea of pre stressed concrete bridge.

CEL441 Bridge Engineering

3 Credits (2-0-2)

Introduction- Definition, components of bridge, classification of bridges, selection of site, economical span, aesthetics consideration, necessary investigations and essential design data; Standard specifications for roads and railways bridges: Indian Road Congress Bridge Code for specifications and loads.; Various types of R.C.C. bridges (brief description of each type), Design Consideration for R.C.C. Bridges and culverts.: Design of Tee beam bridge, Various types of steel bridges (brief description of each), Design Consideration for Steel Bridges, Design of plate girder bridges. Hydraulic & Structural Design of piers, abutments, wing wall and approaches: Brief descriptions of bearings, joints, articulation and other details. Bridge foundation-Variety types, necessary investigations and design criteria of well foundation.

CEL442 Quality & Safety in Construction

3 Credits (2-1-0)

Introduction to quality management. Planning and control of quality during design of structures. Quality assurance during

construction. Inspection of materials and machinery. Preparation of quality manuals, check-list and inspection report. Establishing quality assurance system. Quality standards/codes in design and construction. Concept and philosophy of total quality management (TQM). Training in quality and quality management systems (ISO-9000). Concept of safety. Factors affecting safety: Site management with regard to safety recommendations. Training for safety awareness and implementation. Formulation of safety manuals. Safety legislation, standards/codes with regard to construction. Quality vs Safety. Case Studies

CEL443 Environmental Policy, Legislation and Economics

3 Credits (2-0-2)

Indian Constitution and Environmental Protection, Principle and Policy, Protocol and agreement, Environmental Protection Responsibilities, scheme etc., Cost benefit analysis, Life cycle assessment, Risk Analysis Relevant Provisions of Indian Forest Act.

CEL445 Geosynthetics and Reinforced Soil Structures

3 Credits (2-0-2)

Introduction; Different types of geosynthetics; Testing methods for geosynthetics; Reinforced Soil retaining walls; Reinforced soil slopes; Applications in foundations, drainage and filtration, Pavement and landfills, Soil nailing, Fibre-reinforced soil

CEL442 Smart Structures

3 Credits (2-0-2)

Introduction to passive and active systems – need for active systems – smart systems – definitions and implications – active control and adaptive control systems – examples. Components of smart systems – system features and interpretation of sensor data – pro active and reactive systems – demo example in component level – system level complexity Materials used in smart systems – characteristics of sensors – different types smart materials – characteristics and behaviour of smart materials – modelling smart materials – examples. Control Systems – features – active systems – adaptive systems – electronic, thermal and hydraulic type actuators – characteristics of control systems – application examples. Integration of sensors and control systems – modelling features – sensor-response integration – processing for proactive and reactive components – FE models – examples

CEL444 Environmental Impact Assessment

3 Credits (2-0-2)

Introduction, EIA as research, decision making, in Global Affairs, History & Legal basis of NEPA and the EIA process, General procedure and assessment techniques, Standards and guidelines, Public Participation, EIS, Environmental monitoring, Environmental Management Plan, Methods for Prediction and assessment of impacts.

CEL432 Finite Element Analysis

3 Credits (2-0-2)

Introduction to Finite Element Method. Brief History of the Development. Advantages & Disadvantages of Finite Element Method. Finite Element Method- The Displacement Approach. Foundations of the FEM Energy Principles. One Dimensional Finite Element. Stiffness Matrix for the basic Bar & Beam Element. Element Stresses. Shape Functions & Interpolation Polynomials. Finite Elements for Two Dimensional Planar Bodies. Triangular Elements for Plane Stress or Strain Conditions. Rectangular Elements for Plane Stress or Strain Conditions. Finite Elements for Three Dimensional Analysis. Tetrahedral Elements. The Isoparametric Concept. Properties of Isoparametric Elements. Numerical Integration. Finite Elements for Plate Bending Analysis. Applications of FEA to field problems.

CEL434 Design of Hydraulic Structures

3 Credits (2-0-2)

Diversion head work- Weirs; storage head work -gravity dams- earth dams, Distribution systems canals; canal regulation works; Water logging and drainage, Software Application.

CEL436 Ground water Hydrology

3 Credits (2-0-2)

Occurrence, types and properties of formations, Darcy's law, well hydraulics, ground water yield, water quality, ground water explorations, water wells, ground water modeling, sea water intrusion, basin management with artificial recharge, water harvesting and conjunctive use.

CEL438 Atmospheric Diffusion & Air Pollution

3 Credits (2-0-2)

Definition and Effects of Air Pollutants and Aerosols on Environment, Residence time of air pollutants, Air Quality Modeling: Approaches to model formulation from basic diffusion equation, Different Models namely Gaussian, Deterministic, numerical and Statistical and criteria of their selection for different situations, Dispersion parameters, Plume rise formulae, Wind and Pollution roses, Air quality standards, norms and regulations, Application of air quality models for Environmental Impact Assessment studies of industrial Complexes, Power plants and Vehicular traffic; Chemical Removal processes: Dry and wet Depositions. Hand-on training of models

CEL402 Disaster Management

3 Credits (2-0-2)

Introduction to disaster, Hazards, Vulnerability, Resilience, Risks, Disaster cycle – its analysis, Phases, Disaster cycle – its analysis, Different type and detailed study of natural disasters, earthquakes, floods, Drought, landslide, land subsidence, and cyclones, Volcanoes, tsunamis. General causes of different disasters, Effects of natural disasters on human beings and environment, Disaster management policy, Seismic micro zonation, Seismic Zonation map of India, Early warning system prevention, mitigation and preparedness, structural-nonstructural measures, Disaster related infrastructure development, Hazard and Vulnerability profile of India, differential impacts, impact of development projects such as dams, embankments, changes in land use etc., Climate change adaptation, act and policy, other related

policies, plans, programmes and legislation, Awareness generation programme, Mitigation and adaptation strategies.

CEL448 Ground Improvement Techniques

3 Credits (2-0-2)

In-situ densification of soils, Ground Improvement techniques –compaction/dynamic compaction, vibro compaction, shallow and deep stabilization, stone column, reinforced earth, application of geosynthetics, grouting in soils-compaction, soil fraction, jet or replacement grouting techniques, hydraulic modification, Physical & Chemical Modification, Modification with inclusions & Confinement

CEL452 Smart Materials & Composites

3 Credits (2-1-0)

Classification and Characteristics of Composite Materials-Basic Terminology, Advantages. Stress-Strain Relations, FRP composites - types, mechanics, behavior, properties and application; Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions – Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness; Special Cementitious systems; Concrete- Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete – Ferro cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing; Mechanical Properties Behavior of Ferro cement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact; Analysis and Design of Cement Composite Structural Elements Application of Cement Composites: Housing, Water Storage, Boats and Miscellaneous Structures.

CEL453 Smart Waste Management

3 Credits (2-1-0)

Introduction to Solid Waste Management, Municipal Solid Waste Characteristics and Quantities , MSW Rules 2016, Swachh Bharat Mission and Smart Cities Program, Municipal Solid Waste Collection, Transportation, Segregation and Processing, Disposal of Municipal Solid Waste: Landfill ,Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste, Current Issues in Solid Waste Management and Review of MSW Management Status in First List of 20 Smart Cities in the Country, Construction and Demolition (C&D) Waste Management – Overview, C&D Waste – Regulation, Beneficial Reuse of C&D Waste Materials, Electronic Waste (E-Waste) Management – Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges

CEL454 Smart Transportation Systems

3 Credits (2-1-0)

Introduction of Intelligent Transportation System (ITS) - Advanced Traffic Management Systems – Advanced Vehicle Control Systems - Automated Highway Systems - Advanced Highway Materials – Self healing and smart materials - Green Pavements - Urban Transportation

CEL456 Advanced Methods of Management Research

3 Credits (2-1-0)

Problem conceptualization and definition. Hypothesis formulation. Selection of Research Methods, Flexible Systems Methodology for preparing research design, Scaling, sampling methods, Managing oral evidence, Questionnaire design, validation and pretesting. Interview design, Case study, Field experiments, Quasi experiments. Qualitative research methods. Statistical techniques and implementation of research plan using statistical packages.