

Department of Civil & Environmental Engineering

The department of Civil & Environmental Engineering offers the following programmes during the academic year 2019-20.

- Master of Technology (M.Tech.) in Civil Engineering with specialization in Structural Engineering, Construction Engineering & Management and Environmental Engineering
- Bachelor of Technology (B.Tech.) in Civil Engineering with Specialization options in Smart Infrastructure Development and Construction & Project Management.

M.Tech. in civil engineering programme will impart advanced knowledge in the selected disciplines of civil engineering and prepare the students for bright career in industries, research and academic institutions within India and abroad. The programme will be of 2 years duration with 4 semesters for full time and 3 years with 6 semesters for part time. The programme has total credits of 54. The curriculum is designed in such a way that there are specialization options in structural engineering, Construction engineering and Management, and Environmental engineering. Students can opt for any one of these specializations by taking the relevant programme electives, seminar, minor project and major project in those specializations.

The curriculum of B.Tech. Civil engineering will prepare the graduates for suitable employment in civil engineering and related disciplines and prepare graduates with basic competence required to pursue advanced study and research in civil engineering and related disciplines. While framing the curriculum, not only the technology development in civil engineering but also the technology development in information technology, biotechnology, satellite communications, computers and materials have been taken into account. The programme has total credits of 167. Along with a B.Tech. degree in Civil Engineering students will also have an option of taking up a specialization in Smart Infrastructure Development and Construction & Project Management. Out of the total courses run, specific courses on soft skills development and value added courses on technical skills have been added to improve the employability skills required in Industry.

M.Tech. in Civil Engineering (2019-20)

(with specialization in Structural Engineering / Construction Engineering and Management/ Environmental Engineering)

Semester	Course Name						Skill Development Program/	Lecture Courses	L	T	P	Contract hours per week	Credits
I	CEL501 Sustainable Built Environment 2-0-2 (3)	CEL502 EI&RA 2-0-2 (3)	CEL503 Safety and Reliability Analysis 2-0-2 (3)	CEL504 Advanced Concrete Technology 2-0-2(3)	CEL505 Optimization techniques in Civil Engineering 2-0-2(3)	CEC501 Seminar & General Proficiency 0-0-2(1)		5	10	0	12	22	16
II	OE-I 2-0-2(3) MOOC*	PE-1 2-0-2(3)	PE-2 2-0-2(3)	PE-3 2-0-2 (3)	Laboratory Training 6hrs/week 0-0-6(3)	MAL616 Introduction to Research Methodology 2-1-0 (3)		5	10	1	14	25	18
Summer Internship/Software training/Mini-Project CED 524													02
III	OE-II 2-0-2(3) MOOC*	PE-4 2-0-2 (3)	CED601 Dissertation Part-I 0-0-8(4)					2	4	0	12	16	10
IV	CED602 Dissertation Part-II 0-0-16(8)							0	0	0	16	8	08
Total													54

Scheme of Studies (M.Tech)

Category	PC	PE	Total
Credits	33	21	54

Programme Core (PC)

S.No.	Course Code	Title	L-T-P	Credits
1.	CEL501	Sustainable Built Environment	2-0-2	3
2.	CEL502	Environmental Impact and Risk Assessment	2-0-2	3
3.	CEL503	Safety and Reliability Analysis	2-0-2	3
4.	CEL504	Advanced Concrete Technology	2-0-2	3
5.	CEL505	Optimization Techniques in Civil Engineering	2-0-2	3
6.	MAL616	Introduction to Research Methodology	2-1-0	3
7.	CEC501	Seminar & General proficiency	0-0-2	1
8.	CED524	Minor Project/practical training	0-0-0	2
9.	CED601	Dissertation Phase – I	0-0-8	4
10.	CED602	Dissertation Phase – II	0-0-16	8
		Total Credits		33

Programme Elective (PE)

Sl. No.	Course Code	Title	L-T-P	Credits	Remark
PEI					
1.	CEL506	Prestressed Concrete Structures	2-0-2	3	SE
2.	CEL507	Design of Industrial structures	2-0-2	3	
3.	CEL508	Finite Element Analysis	2-0-2	3	
4.	CEL509	Functional Planning, Building Services and Management	2-0-2	3	CT&M
5.	CEL510	Construction and Contract Management	2-0-2	3	
6.	CEL511	Infrastructure Development and Management.	2-0-2	3	
7.	CEL512	Environmental Chemistry	2-0-2	3	EE
8.	CEL513	Water Supply Engineering	2-0-2	3	
9.	CEL514	Industrial Waste Management	2-0-2	3	
PEII					
1.	CEL515	Structural Dynamics	2-0-2	3	SE
2.	CEL516	Principles of Bridge Engineering	2-0-2	3	
3.	CEL517	Theory of Elasticity and Plasticity	2-0-2	3	
4.	CEL518	Resource Management and Control in Construction	2-0-2	3	CT&M
5.	CEL519	Construction Economics & Finance	2-0-2	3	
6.	CEL520	Shoring, Scaffolding and Formwork	2-0-2	3	
7.	CEL521	Geo-Environmental Engineering	2-0-2	3	EE
8.	CEL522	Global Climate Change Adaptation and Mitigation	2-0-2	3	
9.	CEL523	Waste Water Engineering	2-0-2	3	
PEIII					
1.	CEL524	Matrix Methods of Structural Analysis	2-0-2	3	SE
2.	CEL525	Prefabricated Structures	2-0-2	3	
3.	CEL526	Theory of plates and shells	2-0-2	3	
4.	CEL527	Quality And Safety in Construction	2-0-2	3	CT&M
5.	CEL528	Strategic Technology Management	2-0-2	3	
6.	CEL529	Flexible Systems Management	2-0-2	3	
7.	CEL530	Environmental Policy, Legislation	2-0-2	3	EE
8.	CEL531	Advanced Waste Water Treatment	2-0-2	3	
9.	CEL532	Air Pollution and Control	2-0-2	3	
PEIV					
1.	CEL603	Finite Element Analysis	2-0-2	3	SE

Sl. No.	Course Code	Title	L-T-P	Credits	Remark
2.	CEL604	Design of Tall Structures	2-0-2	3	
3.	CEL605	Earthquake Resistant Design of Structures	2-0-2	3	
4.	CEL606	Project Planning and Control	2-0-2	3	CT&M
5.	CEL607	Advanced Methods for management research	2-0-2	3	
6.	CEL608	Organization Management	2-0-2	3	
7.	CEL609	Solid and Hazardous Waste Management	2-0-2	3	EE
8.	CEL610	Environmental Hydraulics and Hydrology	2-0-2	3	
9.	CEL611	Environmental Modeling and Simulation	2-0-2	3	

Master of Technology in Civil Engineering
Department of Civil and Environmental Engineering

CEL501 Sustainable Built Environment

3 Credits (2-0-2)

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.

CEL502 Environmental Impact & Risk Assessment

3 Credits (2-0-2)

Planning and Management of Environmental Impact Studies. Impact indentation methodologies: base line studies, screening, scoping, checklist, networks, overlays. Prediction and assessment of impacts on the socio-economic environment. Environmental cost benefit analysis. Decision methods for evaluation of alternatives. Case Studies. Environmental impact assessment at project level, regional level, sectoral level, and policy level. Sustainable development; Environmental policy in planned, mixed and market economies; global environmentalism. Preventive environmentalism. Preventive environmental management

CEL503 Safety and Reliability Analysis

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.

CEL504 Advanced Concrete Technology

3 Credits (2-0-2)

Concrete Making Materials Aggregates – Classification, IS specifications, Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates. Cement Chemical composition, Hydration of cement, structure of hydrated cement, special cements, and water chemical admixtures. Concrete Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and Shrinkage, Variability of concrete strength. Mix Design Principles of concrete mix design, Methods of concrete mix design, testing of concrete. Special Concretes Light weight concrete, Fiber

reinforced concrete, Polymer concrete, Super plasticized concrete, Properties and applications. Concreting Methods Process of manufacturing of concrete. Methods of Transportation, placing and curing. Extreme weather concreting, special concreting methods.

CEL505 Optimizat on Techniques in Civil Engineering

3 Credits (2-0-2)

Optimization Introduction – Formulation of LPP – Geometry of LPP and Graphical Solution of LPP – Solution of LPP: Simplex Method – Big M Method – Two Phase Method – Special cases in simple applications – Introduction to Duality Theory – Dual Simplex Method – Optimization of Transportation Problems – Project Management – Path Analysis

MAL 616 Research Methodology

3 credits (2-1-0)

Foundations of Research, Scientific Research, Motivation, Research Objectives, Research Designs, Research Processes, Understanding Feasibility of Objectives and Processes, Qualitative and Quantitative Research Methods, Data Collection Processes, Biases in Data Collection, Data Pre-processing, Sampling Distribution and Confidence Intervals, Hypothesis Testing, Interpretation of Results, Literature Review, Technical Writing, Citations, Reference management software, Plagiarism, Software for Detection of Plagiarism.

CEL 506 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.

CEL507 Design of Industrial structures

3 credits (2-0-2)

Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, ultimate load carrying capacity of tension members and compression members, flexural members, and simple portal frames and design Industrial Buildings- Loads, general arrangement and stability, design considerations, design of roof trusses, industrial building frames, Design of Water Tanks Stacks and Towers.

CEL508 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.

CEL509 Functional Planning, Building Services and Management

3 credits (2-0-2)

Building Services- Water supply systems, water services to multistory buildings, building drainage and refuse collection, types of fixtures and fittings, Air Conditioning, Heating & Ventilation, lifts and acoustics, traffic analysis and selection of lifts, selection of acoustical materials, acoustics of auditorium, schools, Functional planning and maintenance of services

CEL510 Construction and Contract Management

3 credits (2-0-2)

Project cost estimation, rate analysis, overhead charges, bidding models and bidding strategies. Qualification of bidders, Owner's and contractor's estimate. Tendering and contractual procedures, Indian Contract Act 1872, Definition of Contract and its applicability, Types of contracts, International contracts, FIDIC, Conditions and specifications of contract. Contract administration, Claims, compensation and disputes, Dispute resolution techniques, Arbitration and Conciliation Act 1996, Arbitration case studies, Professional ethics, Duties and responsibilities of parties. Management Information systems

CEL511 Infrastructure Development and Management.

3 credits (2-0-2)

Infrastructure overview. Private involvement in infrastructure - The Benefits and problems of Infrastructure Privatization. Challenges in Privatization – case study. Challenges to Successful Infrastructure Planning and Implementation- Mapping and Facing the Landscape of Risks in Infrastructure Projects.

Strategies for Successful Infrastructure Project Implementation - Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modelling and Life Cycle Analysis Techniques.

CEL512 Environmental Chemistry

Aquatic Chemistry: Chemical equilibria and kinetics fundamentals; Acids and bases; Titrations; Acidity; Alkalinity; Buffers and buffer intensity; Chemical equilibrium calculations; pC-pH diagram. Precipitation and dissolution; Water softening and water conditioning; Langelier index; Solubility diagram; Coexistence of phases in equilibrium; Complexation of metal ions and organic complexes in natural water. Oxidation and reduction reactions stoichiometry; Redox couples; pE-pH diagrams; Redox control in natural systems; Basic concepts of organic and colloid chemistry. Soil Chemistry : Weathering reactions; Structure and surface reactions of clays and oxides; Forces at soil-water interfaces. Atmospheric Chemistry : Chemical equilibria and kinetics; Photo-dissociation and free radical reactions; Chemistry of precipitation; Acid rain

CEL513 Water Supply Engineering

Review of public water supply requirements. Sources of water-Surface and subsurface water sources Quality of water-I: physico-chemical parameters of water Quality of water-II: Water microbiology and biology Quality of water-III: water quality standards for chemical, physical and microbiological parameters, processes of treatment, Flow measurement devices - Venturi, Orifice meters, weirs, flumes and gates. Pipeline distribution system analysis and design.

CEL514 Industrial Waste Management

General Characteristics of Industrial Effluents, Effects on Environment - ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and onto land for irrigation - Toxic chemicals from industry. Pretreatment of Industrial Wastewater: Necessity of pretreatment - Equalization - Segregation - Process Changes - Salvaging - By product Recovery. Removal by Reverse Osmosis, Ion Exchange, Electrodialysis, Solvent Extraction, Floatation.- Removal of Refractory Organics - Removal of Nitrogen and Phosphorus. Major Industrial Effluents: Sources, Characteristics and Treatment. Food Industries: Sugar, Dairy, Distilleries Chemical Industries: Paper and Pulp, Tanneries, Textiles, Fertilizers, Pharmaceuticals, Cement and Steel.

CEL515 Structural Dynamics

3 credits (2-0-2)

Free and forced vibration of single degree of freedom (SDOF) system, response to harmonic, periodic, impulsive and general dynamic loading, response of SDOF to earthquake, Free vibration of lumped multidegree of freedom system, Approximate methods for obtaining natural frequencies and mode shapes, Frequency domain analysis of lumped multi-degree of freedom system using normal mode theory, Time domain analysis using numerical integration scheme, Free and forced vibration of continuous systems, Introduction to the dynamics of soil structure interaction problems.

CEL516 Principles of 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.

CEL 517 Theory of Elasticity and Plasticity

3 credits (2-0-2)

Concept of Elasticity - plane stress and plane strain analysis, two dimensional problems in rectangular coordinates - solution by polynomials - Saint- Venant's principle-determination of displacements-bending of simple beams: application of fourier series for two dimensional problems - gravity loading- Two dimensional problems in polar, analysis of stress and strain in three dimensions - differential equations of equilibrium - principle of super position - uniqueness of solution - the reciprocal theorem, torsion of prismatic bars - bars with elliptical cross sections – other elementary solution - membrane analogy - bending of prismatic bars, theory of plasticity - introduction concepts and assumptions - yield criterions.

CEL 518 Resource Management and Control in Construction

3 credits (2-0-2)

Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control. Labour management-Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use. Material and equipment-Time of purchase, quantity of material, sources, Transportation, Time Management- Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control. Resource allocation and levelling Cumulative cost – Value Management.

CEL519 Construction Economics & Finance

3 credits (2-0-2)

Benefit-cost analysis, Replacement analysis, Break even analysis. Risks and uncertainties and management decision in capital budgeting. Taxation and inflation. Work pricing. Working capitalmanagement, 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.

CEL520 Shoring, Scaffolding and Formwork

3 credits (2-0-2)

Planning of construction work, site equipment required, Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme – Costing. Materials accessories proprietary products – finish materials, scaffolding material, design of forms – analysis of forces, building and erection of formwork, formwork for domes, tunnels etc.

CEL521 Geo-Environmental Engineering

Sources and effects of subsurface contamination; Physical, chemical and biological characteristics of solid wastes; Soil waste interaction; Contaminant transport; Laboratory and field evaluation of permeability; Factors affecting permeability; Waste disposal on land case study; Landfills and impoundments types; Silting criteria; Waste containment principles; Types of barrier materials; Planning and design aspects relating to waste disposal in landfills; Soil exploration at contaminated site; Vertical cutoff walls; Cover system; Recovery well system; Bioremediation of soil; In situ Bioremediation of ground water; Soil washing; Monitoring around landfills; Detection, control and remediation of subsurface contamination; Reclamation of old waste dumps; Regulations; Case studies; Engineering properties and geotechnical reuse of waste materials.

CEL522 Global Climate Change Adaptation and Mitigation

Introduction to global climate; Global climatic models; Methods of reconstructing climate; Quaternary climates, sea level changes, glacial/interglacial cycles; Geological records of climate change, sedimentology, stable isotopes, geochemistry; Geochronology – relative and numerical methods; Vegetation dynamics, migration history, response of vegetation to climatic reversals

CEL523 Waste Water Engineering

Wastewater Characteristics, Standards of Disposal, Treatment Objective and, Strategies, Layouts of Primary, Secondary and Advanced Treatment Units. Design Of Preliminary And Primary Treatment Operations, Biological Treatment Processes: Types, Kinetics of Plug Flow and Completely Mixed Systems. Aerobic and Anaerobic Sludge Digestion Processes, Design of Digester Tank, Sludge Dewatering, Ultimate Disposal, Sludge Drying Beds, Other Methods of Sludge Treatment.

CEL524 Matrix Methods of Structural 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.

CEL525 Prefabricated Structures

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) Multistorey buildings and 3) Water tanks, silos bunkers etc.,4) Application of prestressed concrete in prefabrication

CEL526 Theory of Plates and Shells

3 credits (2-0-2)

Bending theory of flat plates: thin plates, Kirchoff theory - strain displacement relations, stresses and stress resultants, constitutive equations, equilibrium equations, boundary conditions, derivation of theory from principle of virtual work, rectangular plates-solution by double Fourier series, circular plates Classical theory of shells – Membrane theory of shells: equilibrium equations, applications to shells of revolution under axisymmetric loads, applications to cylindrical shells under asymmetric loads, strain-displacement relations , application in calculation of displacements; Bending theory of shells: kinematic assumptions and strain-displacement relations, stress measures and equilibrium

CEL527 Quality and Safety in Construction

3 credits (2-0-2)

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

CEL528 Strategic Technology Management

3 credits (2-0-2)

Emerging technology-strategy relationship in the large corporation. Global technology comparison. Technology Information. Criticality of technology for growth, core competencies, R&D productivity, Generic competitive technology strategies. Corporate R&D, Strategic technology management process, relationship between technology strategy and corporate strategy. Strategic shifts and resource commitments, technology leadership. SWOT analysis for technology, Matching Business Portfolio and Technology Portfolio, Technology- Market matrix. Innovation and entry strategy.

CEL529 Flexible Systems Management

3 credits (2-0-2)

Emerging management paradigms: Total Quality Management, Business Process Reengineering, Learning Organisation, World Class Organisation, Flexibility in Management. Concept of systemic flexibility. Liberalisation, Globalisation and change. New Organisation forms. Concept and dimensions of Systemic flexibility. Managing paradoxes. Methodology and tools of flexible systems management. Underlying values, and guiding principles, Case Analysis using SAPLAP framework. SAP-LAP models and linkages

CEL530 Environmental Policy and Legislation

3 credits (2-0-2)

Introduction: Economics and Environmental Policy Theory of externalities: Relevance. Externalities: definitions, significant types, and optimal pricing conditions, formal analysis Uncertainty and choice of policy instruments: price or quantity controls. Market imperfections and the number of participants. Detrimental externalities, and nonconvexities in the production set, optimal pricing of exhaustible resources Introduction to design of Environmental policy. Efficiency without optimality: the charges and standard approaches Marketable emission permits for the protection of the environment. Stochastic influences, direct controls, and taxes. Taxes vs subsidies: a partial analysis. Environment protection and the distribution of income International environmental issues, National and local standards for environmental quality

CEL531 Advanced Waste Water Treatment

3 credits (2-0-2)

Microbiological concepts; cells, classification and characteristics of living organisms, characterization techniques, reproduction, metabolism, microbial growth kinetics and kinetics of biochemical operations; Modeling of suspended growth systems, techniques for evaluation of kinetic and stoichiometric parameters. Optimal selection of water and waste water treatment chain, engineered systems, concepts and principles of carbon oxidation, nitrification, denitrification, methanogenesis. Biological nutrient removal; Anaerobic treatment (process options, components of anaerobic reactions that influence process design); Attached growth reactors (process description, design and applications). Decentralized wastewater treatment systems; Low cost options, constructed wetlands. Reliability and cost effectiveness of wastewater systems.

CEL532 Air Pollution and Control

3 credits (2-0-2)

Sources & Classification of Air Pollutants, Global effects, Sampling of Pollutants in ambient air, Meteorology and Air Pollution, Control of Particulate Pollutants, Design and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters & ESP, Control of Gaseous Pollutants, Automobile Pollution and Control, Other Management controls, AP Legislation.

CED 601 Dissertation Phase - I

4 credits (0-0-8)

Part-I of the dissertation will cover the problem identification followed by literature review, data collections and data generations and identification of the tool of analysis, simulation and modeling and hypothesis for the problem solving, some basic trail studies.

CED 602 Dissertation Phase – II

8 credits (0-0-16)

Part-II of the dissertation will cover the actual detailed experimentation, simulation, modeling, result generation and reaching to the desired goal set in Part-I. Report writing and publication.

CEL603 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 Representation of Distributed Loading.

The Assembly Process within the PMPE Approach. Element Stresses. Shape Functions & Interpolation Polynomials. Refined One Dimensional Element. Finite Elements for Two Dimensional Planar Bodies. Triangular Elements for Plane Stress or Strain Conditions. Higher Order Triangular Elements. Rectangular Elements for Plane Stress or Strain Conditions. Higher Order Rectangular Elements, Lagrange Element Family. Finite Elements for Three Dimensional Analysis. Tetrahedral Elements. Higher-Order Tetrahedral. Rectangular Hexahedral Elements. Higher-Order Rectangular Hexahedra, Lagrange Element Family. Advanced Concepts In The Formulation of Two & Three Dimensional Elasticity Elements. Natural Co-ordinates. Area or Triangular Co-ordinates. Serendipity Rectangles & Hexahedra. The Isoparametric Concept. Properties of Isoparametric Elements. Numerical Integration. Finite Elements For Plate Bending Analysis. A 12-Degree-Of-Freedom Rectangular Element (R1). Triangular Elements

CEL604 Design of Tall Structures

3 credits (2-0-2)

Design philosophy – Loading - Sequential loading, materials. High risk behaviour, 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

CEL605 Earthquake Resistant Design of Structures

3 credits (2-0-2)

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 desing concepts, response reduction factor, stiffness and building configuration, lateral loads, IS 1893 provisions for buildings, active and passive vibration control, dampers.

CEL606 Project Planning and Control

3 credits (2-0-2)

Work study, work break down structure, time estimates, application of CPM/PERT, statical concepts, Man-Material-Machinery-Money optimization, scheduling, monitoring, updating. Cost function, time-cost trade off, resource planning-levelling and allocation. Resources – based network, crashing, master network, interface activities, and dependencies, line

of balancing techniques, application of digital computer. Material management- purchase management and inventory control, ABC analysis. Human resource management

CEL607 Advanced Methods for management research

3 credits (2-0-2)

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.

CEL608 Organization Management

3 credits (2-0-2)

Manpower planning, organizing, staffing, directing. Organization -span of control, organization chart, development and operation of human resource, managerial staffing, recruitment, selection, placement, training. Human behavior – basic individual psychology, managing groups at work, leadership, behavioural aspects of decision making and communication for people management. Welfare measures – compensation, safety and health, GPF, EPF, group insurance,. Management and development methods

CEL609 Solid and Hazardous Waste Management

3 Credits (2-0-2)

Municipal Solid Waste : Generation, Rate Variation, characteristics (Physical, Biological and Chemical); Management Options for Solid Waste, Waste Reduction at the Source, Collection techniques, Materials and Resources Recovery / Recycling. Transport of Municipal Solid Waste, Routing and Scheduling, Treatment, Transformations and Disposal Techniques (Composting, Vermi Composting, Incineration, Refuse Derived fuels, Landfilling). Norms, Rules and Regulations. Economics of the on-site v/s off site waste management options. Integrated waste management.

CEL610 Environmental Hydraulics and Hydrology

3 credits (2-0-2)

Basic concepts of open channel flows, conservation laws, continuity equation, momentum equation, Application of momentum and energy equations Critical flow, its properties and application; location of critical flow and its computation Uniform flow, flow resistance, equations of flow resistance, computation of normal depth, Gradually varied flow, governing equations classification of water surface profiles Rapidly varied flow, application of conservation laws, channel transition, supercritical flow, Hydraulic Jump Hydrologic cycle and its interaction with human activity, Hydrologic processes,

Hydrologic analysis, Hydrologic statistics. Transport processes, diffusion phenomena, Fick's 1st and 2nd Laws of diffusion, Advection diffusion equation, Turbulent diffusion and dispersion mixing in rivers Porous medium flow, Approximation of Dupuit, Contaminant transport, Saltwater intrusion into aquifers, Non aqueous phase liquid (NAPL) in groundwater, aspects of numerical modelling

CEL611 Environmental Modeling and Simulation

3 credits (2-0-2)

Sources and effects of water pollutants, introduction to principles of water quality modeling, distribution of water quality in rivers, estuaries and lakes, contaminant transport in groundwater, water quality modeling applications and discussion of case studies. Sources and effects of air pollutants, air quality standards, and emission inventory, meteorological aspects related to air pollution, air quality modeling and its application, trans-boundary air pollution.

Bachelor of Technology in Civil Engineering (with Specialization)
Department of Civil and Environmental Engineering (2019-20)

Sem ester										Community Service	L	T	P	Contact hours per week	Credits
I	MAL151 Engineering Maths-I (3-0-2) 4	CHL150 Engg. Chemistry (1-0-2) 2	CLL101 Eff. Comm.-I (2-0-0) 2	CSL106 FOCP-I (2-0-6) 5	MEP110 Engg Graphics & Drg (1-0-3) 2.5	CLL 120 Human Values and professional Ethics (1-0-1) 1.5	CSL110 Problem Solving and design thinking (0-0-4) 2		CER101 GP (1)		10	0	18	28	19+1 = 20
II	MAL152 Engineering Maths-II (3-0-2) 4	PYL150 Engineering Physics (3-0-2) 4	CLL102. Eff. Comm.-II (2-0-0) 2	CSL108 FOCP-II (2-0-6) 5	MEL150 Basics of Mechanical and Civil Engineering (2-0-2) 3	ECL110 Basics of Electrical & Electronics Engg. (2-0-2) 3			CER102 GP (1)		14	0	14	28	21+1 = 21
CET102 Summer Camp (2 weeks)															02
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 GP (1)	CES201 CS-III (35 Hours)	18	1	4	23	21 + 1 = 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)		CEV202 Value Addition Course (1)	CER202 GP (1)	CES202 CS-IV (35 hours) (1)	15	2	6	23	21 + 2 = 23
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 GP (1)	CES301 CS-V (35 hours)	15	2	4	21	19 + 1 = 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 GP (1)	CES302 CS-VI (35 hours) (1)	15	1	4	20	19 + 2 = 21
CET 330 Practical Training-II @ construction site (8-10 weeks)															03
VII	PE 3 (3)	PE 4 (3)	PE 5 (3)	SML300 Entrepreneurs hip 3-0-0 (3)	OE-4 (3)		CED304 Major Project(A) 0-0-8(4)	CEV401 VA Course (1)	CER401 GP (1)	CES401 CS-VII (70 hours)	15	0	8	23	20 + 1 = 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 GP (1)	CES402 CS-VIII (70 hours) (2)	6	0	12	18	12 + 3 = 15
TOTAL															159 + 12 = 171
*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															

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 two 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 the student wants to get B.Tech in Civil Engineering (with specialization) then areas in which he/she can do 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 will be free to do final year Major Project in any field pertaining to Civil Engineering.
- If the student is willing to go for the 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 choose to do B.Tech. in Civil Engineering (with specialization), a separate certificate of specialization upon 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 (2019-20)

Undergraduate Course Categories			
Category	Credits	Category	Credits
Basic Sciences (BS)	17	SPT	20
ES & TA	21.5	GP	08
HMS Core	9.5	Program Electives (PE)	21
Program Core (C)	58	Open Electives (OE)	12
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	1	0	2	2
CHL100	Environmental Studies	3	0	0	3
Engineering Sciences and Technical Arts (ES & TA) Core					
CSL106	FOCP-I	2	0	6	5
CSL108	FOCP-II	2	0	6	5
MEL150	Basics of Mechanical & Civil Engineering	2	0	2	3
MEP110	Engineering Graphics and Drawing	1	0	3	2.5
ECL 110	BEEE	2	0	2	3
CSL110	Problem Solving and design thinking	0	0	4	2
CEP302	Computer Aided Design and Drawing	0	0	2	1
Humanities and Management Sciences					
CLL101	Effective Communications I	2	0	0	2
CLL102	Effective Communications II	2	0	0	2
CLL120	Human Value & Professional Ethics	1	0	1	1.5
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	0	2	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	0	2	4
CEL318	Earthquake Resistant Design of Structures	3	0	2	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
CEV202	Value Added Course	-	-	-	2
CEV401	Value Added Course	-	-	-	2
Programme Electives					
IV semester PE-1					
CEL216	Air Pollution and Control	2	1	0	3
CEL218	Open Channel Flow	2	1	0	3
CEL222	Estimation and Costing in Civil Engineering	2	1	0	3
	Selected Topics	-	-	-	3
VI semester PE-2					
CEL302	Foundation Engineering	2	0	2	3
CEL304	Solid Waste Management	2	1	0	3
CEL316	Railways, Harbors, Docks & Airports	2	1	0	3

CEL318	Urban Town Planning	2	1	0	3
	Selected Topics	-	-	-	3
VII semester PE-3					
CEL424	Advanced Design of Steel Structures	2	1	0	3
CEL426	Construction Practices	2	1	-	3
CEL436	Ground water Hydrology	2	1	0	3
CEL438	Atmospheric Diffusion & Air Pollution	2	1	0	3
CEL440	Green Buildings	2	1	0	3
CEL442	Quality & Safety in Construction	2	1	0	3
	Selected Topics	-	-	-	3
VII semester PE-4					
CEL411	Advanced Design of Concrete Structures	2	1	0	3
CEL413	Water Power Engineering	2	1	0	3
CEL415	Transportation Economics, Planning and Management	2	1	0	3
CEL417	Geotechnical Investigation & Instrumentation	2	1	0	3
CEL419	Remote Sensing & GIS	2	1	0	3
CEL434	Design of Hydraulic Structures	2	1	0	3
CEL452	Smart Materials & Composites	2	1	0	3
CEL422	Construction Economics and Finance	2	1	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	2	1	0	3
CEL454	Smart Transportation Systems	2	1	0	3
CEL426	Construction Practices	2	1	0	3
CEL448	Ground Improvement Techniques	2	1	0	3
	Selected Topics	-	-	-	3
VIII semester PE-6					
CEL431	Climate Change Sustainability	2	1	0	3
CEL433	Prefabricated Structures	2	1	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	2	1	0	3
CEL456	Advanced Methods of	2	1	0	3

	Management Research				
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	2	1	0	3
CEL445	Geosynthetics and Reinforced Soil Structures	2	1	0	3
CEL442	Smart Structures	2	1	0	3
CEL444	Environmental Impact Assessment	2	1	0	3
CEL402	Disaster Management	2	1	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 (3-0-2)

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

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 (2-0-2)

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 (2-0-2)

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 (2-0-2)

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 (2-0-2)

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 (3-0-2)

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 (3-0-2)

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 (2-0-2)

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 (2-0-2)

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 (2-0-2)

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 (2-0-2)

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 (2-0-2)

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 (2-0-2)

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

CEL426 Construction Practices

3 Credits (2-0-2)

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)

2 Credits (0-0-4)

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 behaviour, 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

CED305 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) Multistorey 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.

CEL440 Green Building

3 Credits (2-1-0)

Classification of climate zones, Thermal comfort, review of traditional architecture, Green building concepts and Components of green buildings. Other areas such as effective ways to utilize energy and promote water efficiency, Earth to air heat exchanger systems (EAHE), EAHE Design, factors affecting EAHE system, Energy efficient ratio, Star rating in India, Heat flow calculations in buildings as also dealt with. The Unsteady heat flows through walls, roof, windows etc. solar chimney-based hybrid system. Rainwater harvesting and artificial recharge structures designs for buildings are need of the hour areas of study and are duly included in the syllabus. Followed by passive and low energy concepts and applications. Passive cooling/heating concepts, building form and orientation, internal and external shading devices, ventilation etc, Case studies of non-air conditioned and air-conditioned buildings, Heating, Ventilation and air conditioning (HVAC) systems, different components of HVAC systems are also touched upon for completeness.

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.

