PROFESSIONAL CORE – I

CEC601	CONCRETE STRUCTURE-II	PC-I	3-1-0	4 Credits

Pre-requisites: Strength of Materials

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Design of Residential Buildings: fundamentals of multi-storey buildings, analysis of various loads: gravity, wind, earthquake loads., method of substitute frames, design examples, bending moments in columns, analysis of multistory frames subjected to horizontal loads.	**12**
2.	Design of RCC water tanks: Uncracked structures and determination of basic parameters, Revision of working stress design philosophies. Introduction to water tanks and their classifications, Important IS codes and its provisions, Analysis and design of Circular water tanks with flexible base and restrained base. Analysis and design of Rectangular water tanks, Analysis of Overhead tanks, Intze tank - basic geometrical configurations; analysis methods; design of top domes, cylindrical walls, ring beam.	**12**
3.	Design of Silos and Bunkers: Introduction, difference between bunker and silo, design of square or rectangular bunkers, design of circular bunkers, design examples, silos for storage of cement, design examples.	**10**
4.	Design of Simple Bridges: Bridges – basic definition, importance, classification., Site investigations for design of a bridge, Various loads and their combinations, Relevant IRC codes and its provisions, Introduction to RC bridge -, design of Culvertand T-beam bridge,.	**12**

PROFESSIONAL CORE – II

CEC602	STRUCTURAL ANALYSIS II	PC-II	2-1-0	3 Credits

Prereq uisites: Structural Analysis I

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Analysis of fixed beams, continuous beam, simple frames and redundant frames with and without translation of points. Method of consistent deformation, Strain energy method, Slope deflection method, Moment distribution method.	12
2.	Analysis of two hinged arches. Suspension bridges with two hinged stiffening girder.	10
3.	Structural theorems:-Linearity principle of superposition,virtualwork,energy theorems, reciprocal theorems, Muller's Breslau's principles.	6
4.	Basics of force and displacement matrix methods for beams,plane frame (rigid and pin-pointed)	10
5.	Influence lines:-Influence lines for propped cantilevers,continuous beams and two hinged arches	10

PROFESSIONAL CORE – III

CEC603	HIGHWAY ENGINEERING	PC-III	2-1-0	3 Credits

Prerequisites: None

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.	6
2.	Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal and vertical alignment; Grade compensation	12
3.	Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; Design of signals, design of road intersections; design of parking facilities; highway lighting; problems	10
4.	Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems	12

5.	Pavement materials- Materials used in Highway Construction - Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems	**8**

PROFESSIONAL ELLECTIVE – I

CEP604	**WATER RESOURCE ENGINEERING II**	**PE – I**	**2-1-0**	**3 Credits**

Prerequisites: Water Resources Engineering I

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Irrigation Principles and planning Definition of Irrigation, development of irrigation in India. Benefits and ill effects of Irrigation. Types of method of irrigation system. quality of irrigation water, water requirements and irrigation scheduling, duty and data & base periods and their relationship, improvements of duty.	**10**
2.	Canal design and layouts , types of canal Canal alignment – Canal design – Kennedy's Silt theory method, Laceyes regime theory. RangaRaju and Misri Method. Basak Method, Tractive shear approach ,layout of canals. Conveyance losses.	**10**
3.	Diversion head Works, Layout of diversion head works, Components of head works, Bligh's and lane's theories, Khosla theory, Design of weir& Barrage	**8**
4.	Canal Regulation Works: Different types of regulation works, Types and Design of falls. Types and design of regulators, Cross regulator, head regulator, canal escapes, canal modulus etc.	**8**
5	Cross – Drainage Works Types of cross-drainage works and design of aqueducts. River Training Works Meandering of rivers, cut off, spurs, guide banks ,marginal embankment. Channel Improvements	**6**

CEP605	**PAVEMENT DESIGN**	**PE – I**	**2-1-0**	**3 Credits**

Prerequite: Highway Engineering

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction: Types and component parts of pavements,	**6**

	Factors affecting design and performance of pavements. Highway and airport pavements.	
2.	Stresses and Deflection sin Flexible Pavements: Stresses and deflection sin homogeneous masses. Burmister's two layer theory, three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behaviour under transient traffic loads.	**10**
3.	Flexible Pavement Design Methods For Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC; Stresses in Rigid Pavements: Types of stresses and causes, factors in fluencing the stresses; general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.	**10**
4.	Rigid Pavement Design: Types of joint sin cement concrete pavements and their functions, joint spacings; design of CC pavement for roads and run ways as per IRC, design of joint details for longitudinal joints, contraction joints and expansion joints. IRC method of design by stress ratio method.	**10**
5	Design of continuously reinforced concrete pavements; Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete over lays as per IRC	**8**

CEP606	**BRIDGE ENGINEERING**	**PE – I**	**2-1-0**	**3 Credits**

Prerequisites: Highway Engineering

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	General; classification of bridges, site selection, geometric and hydraulic design consideration	**6**
2.	Loading standards for highway and railway bridges, general design consideration; optimum spans; Concrete bridges: culverts; Slab, T-beam, box girder bridges, balanced cantilever bridge, cable stayed bridge, extrados bridges; arch bridge;	**12**
3.	Special requirements for Prestressed Concrete bridges; Steel bridges: plate girder bridge, truss bridge, suspension cable	**12**

	bridge, cable stayed bridge; Substructures: design of piers and abutments, pile and well foundations, bearings and expansion joints, special wearing coats	
4.	seismic design considerations; Aerodynamic stability considerations; special durability measures; provisions for inspection and maintenance;	**10**

CEP607	**STRUCTURAL DYNAMICS**	**PE – I**	**2-1-0**	**3 Credits**

Prerequisites: Structural Engineering I

Detailed Syllabus:

MODULE	**CONTENTS**	**Hrs**
1.	THEORY OF VIBRATIONS Difference between static loading and dynamic loading – Degree of freedom – idealisation of structure as single degree of freedom, – Formulation of Equations of motion of SDOF system – D'Alemberts principles – effect of damping – free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces.	**9**
2.	Two degree of freedom system – modes of vibrations – formulation of equations of motion of multi degree of freedom (MDOF) system – Eigen values and Eigen vectors – Response to free and forced vibrations – damped and undamped MDOF system – Modal superposition methods.	**9**
3.	Elements of Engineering Seismology – Causes of Earthquake – Plate Tectonic theory – Elastic rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters – Magnitude and intensity of earthquakes – Spectral Acceleration.	**9**
4.	Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces as per IS:1893 – 2002 – Response Spectra – Lessons learnt from past earthquakes.	**9**
5	Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Lateral load analysis – Design and detailing as per IS:13920 – 1993.	**9**

CEP608	SYSTEM ENGINEERING AND ECONOMICS	PE – I	2-1-0	3 Credits

Prerequisites: None

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction to the formulation and solution of civilengineeringproblems.Engineering economy, mathematical modeling, andoptimization.	12
2.	Techniques, including classical optimization, linear and nonlinearprogramming, network theory, critical path methods, simulation, decision theory	14
3.	Dynamic programming applied to a variety of civil engineering problems.	12

CEP609	MASONRY STRUCTURES	PE – I	2-1-0	3 Credits

Prerequisites: None

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction to analysis, design and construction of masonrystructures.	8
2.	Mechanical properties of clay and concrete masonry units, mortar, and grout	8
3.	Compressive, tensile, flexural, and shear behavior of masonry structural components.	8
4	Strength and behavior of unreinforced bearing walls. Detailed design of reinforced masonry beams, columns, structural walls with and without openings	8
5	Complete lateral-forceresisting building systems.	8

OPEN ELLECTIVE – I

CEO610	INDUSTRIAL WASTE TREATMENT	OE – I	2-1-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	INTRODUCTION Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control of industrial effluents and hazardous wastes	8
2.	CLEANER PRODUCTION Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.	8
3.	POLLUTION FROM MAJOR INDUSTRIES Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts	9
4.	TREATMENT TECHNOLOGIES Equalisation – Neutralisation – Removal of suspended and dissolved organic solids – Chemical oxidation – Adsorption – Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal	11

CEO611	COMPOSITE MATERIALS	OE – I	2-1-0	3 Credits

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	**Introduction:** Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc. Types of Reinforcements/Fibers: Role and Selection or reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres.	14

2.	**Various types of composites:** Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon - Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites.	**10**
3.	**Fabrication methods: Processing of Composite Materials:** Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin - transplant method, pultrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films.	**8**
4.	Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.	**8**

CEO612	**ENVIRONMENTAL LAWS AND POLICY**	**OE – I**	**2-1-0**	**3 Credits**

Prerequisites: Environmental Engineering

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Overview of environment, nature and eco system, Concept of laws and policies, Origin of environmental law,	**14**
2.	Introduction to environmental laws and policies, Environment and Governance, sustainable development and environment, understanding climate change, carbon crediting, carbon foot print etc.,	**12**
3.	Introduction to trade and environment. International environmental laws, Right to Environment as Human Right International Humanitarian Law and Environment, environment and conflicts management, Famous international protocols like Kyoto.	**14**

CEO613	OPERATIONAL RESEARCH TECHNIQUE	OE – I	2-1-0	3 Credits

Prerequisites: None

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Introduction: History of operation research, nature and scope of operations research, allocation.	10
2.	Linear programming: Mathematical formulations of the problem, Graphical solution methods, mathematical solution of L -P problems, matrix formulation of general linear programming.	10
3.	Simplex Method: Algorithm and computational procedures, Two phase Simplex method, Problems of degeneracy, Principles of duality in simplex method, Sensitivity analysis, Transportation problem.	10
4	Game Theory: Introduction, Two persons zero sum games, the maxmini and minimax principles. Integer Programming: Formulation and solution of integer programming problems	10

Suggested Reading

1. Taha,H A, "Operations Research - An Introduction", Sixth Edition, Prentice Hall of India Private Limited, N. Delhi, 2004.
2. Hillier, F S, "Operations Research", First Indian Edition, CBS Publishers & Distributors, Delhi, 1994.

CEO614	VALUES AND ETHICS IN ENGINEERING	OE – I	2-1-0	3 Credits

Prerequisites: None

Detailed Syllabus:

MODULE	CONTENTS	Hrs
1.	Human Values:Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty –	10

	Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	
2.	Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories	**10**
3.	ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	**10**
4	SAFETY, RESPONSIBILITIES AND RIGHTS Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	**10**
5	GLOBAL ISSUES Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility	**8**

CEO615	**DECISION AND RISK ANALYSIS**	**OE – I**	**2-1-0**	**3 Credits**

Prerequisites: None

Detailed Syllabus:

MODULE	**CONTENTS**	**Hrs**
1.	Development of modern statistical decision theory and	**10**

	riskanalysis, and application of these concepts in civil engineering design and decision making;	
2.	Bayesian statistical decision theory, decision tree, utility concepts, and multi-objectivedecision problems;	**8**
3.	Modelling and analysis of uncertainties, practical risk evaluation, andformulation of risk-based design criteria,	**12**
4	Risk benefit trade-offs, and optimal decisions.	**10**

CE601P Concrete Design Lab

List of Experiments

1. Design a class room for a capacity of 100 students and sketch the reinforcement detailing of different components such as Beam, slab, column and footing.
2. Design the underground water tank and sketch the reinforcement detailing .
3. Design a circular water tank resting on ground and sketch the reinforcement detailing.
4. Design an Intz type water tank and sketch the reinforcement detailing.
5. Design and detailing the reinforcement of a side walls and hopper bottom of a rectangular bunker.
6. Design and detailing the reinforcement of a Silo using Janssen's theory.
7. Design an abutment in concrete for 6.5m span solid slab bridge and sketch the reinforcement detailing.
8. Design and reinforcement detailing of reinforced concrete slab culvert for a national highway.

CE602P Structural Engineering Lab

1. Determination of young's modulus of elasticity of steel, wood and aluminum.
2. Determination of horizontal thrust of a three hinged arch.
3. Determination of Influence Line Diagram of continuous beam.
4. Modern analysis of the different end condition of the column.
5. Verification of Maxwell reciprocal theorem.
6. Determination of Fixed end moment of the Beam.
7. Determination of tensile strength of steel.
8. To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally.
9. Experimental and analytical study of deflection and unsymmetrical bending of a cantilever beam.
10. Experiment on a 2 hinged arch for horizontal thrust and influence line for horizontal thrust.

TRANSPORTATION ENGINEERING LABORATORY

EXPERIMENTAL LISTS

AGGREGATE TESTING

1. GRADATION OF AGGREGATE
2. IMPACT TEST
3. ABRASION TEST
4. ELONGATION AND FLAKINESS INDEX
5. CRUSHING VALUE TEST
6. SPECIFIC GRAVITY AND WATER ABSORPTION TEST

BITUMEN TESTING

1. Penetration Value Test
2. Softening Point (Ring and Ball Test)
3. Ductility test
4. Viscosity Test

CE604P CSQA

CSQA Aims to be done:

1. Estimating and Costing – Meaning, purpose, Administrative Approval, Technical Sanction and Budget provision.
2. Types of estimates – Approximate estimate and detailed estimate.
3. Detailed Estimate- Definition and Purpose, Data required for detailed estimate
4. Procedure of preparation of detailed estimate - Taking out quantities and Abstracting
5. Modes of measurement and Desired accuracy in measurements of different items of work as per IS:1200
6. Long wall and Short wall method (out to out and in to in method or PWD method), Centre line method
7. Description / specification of items of building work as per PWD /DSR
8. Rate Analysis : Definition, purpose, importance and factors affecting
9. Preparing rate analysis of different items of work - PCC,RCC work in (column, beam, lintel, slab), brick masonry, stone masonry, Vitrified tile flooring, plastering,, Wood work for doors
10. Standard formats of Measurement sheet, Abstract sheet, Face sheet