Course No.	Course title	L	T	P/D	Hours	Credit
CED-411	Structural Design – II (Steel structures)	3	1	0	4	3

Design of connections in steel structures:
Bolted and welded connections, assumptions, Different types of joints, design of various types of bolted and welded connections subjected to direct loads and Eccentric Loads.

Design of tension members:
Selection of section, I.S. specifications, design of axially loaded tension members, design of members for axial tension and bending, end connections, design of lug angles and tension splices.

Design of compression members:
Theory of buckling, design of column, cross section (single and built up sections), design of angle struts, eccentrically loaded columns, column splices, lacings and battens.

Design of beams:
Lateral stability, design of single and built up beams, plated beams and curtailment of flange plates.

Design of column bases and column footings:
Slab base, gusseted base, and Grillage Foundation subjected to Axial& Eccentric Loads.

Design of roof trusses:
Types of trusses, roofs and side coverage, types of loadings and load combinations, design of members and connections.

Design of Plate Girder and Gantry Girder
Design of section, stiffeners, splices, design of built up Gantry Girder

Water tanks:
Design of rectangular pressed steel tanks, cylindrical tanks with hemispherical bottom, design of staging.

Books

1. Subramanian,N, Design of Steel Structures, Oxford University Press, New Delhi
2. Duggal , S.K., Design of Steel Structures, Tata Mcgraw-Hill, New Delhi
3. Bhavikatti,S.S., Design of Steel Structures By Limited Method As Per Is 800-2007, I.K.International Publishing House, New Delhi
4. M.R.Shiyekar, Limit State Design in Structural Steel, PHI
5. K.S.Sai Ram,Design of Steel Structures,Pearson.
6. IS 800-2007 Is General Construction in Steel-Code Of Practice,BIS
7. IS 801-1995 Use of cold deformed light gauge steel structural members in general BC.

Course No.	Course title	L	T	P/D	Hours	Credit
CED-412	Environmental Engineering – II (Wastewater collection & Treatment)	3	1	0	4	3

Introduction: System of sanitation and their impact on environment.

Wastewater generation, collection and conveyance: Wastewater Quantity Classification of wastewater; Sewerage system for domestic wastewater and storm water - Collections, and appurtenances ; Design and layout of sewerage systems -Maintenance of sewerage systems Physical, Chemical & Biological characteristics and their significance.

Primary treatment of wastewater: Objectives of Wastewater treatment-Treatment methods: Unit
Operations and Processes Design criteria - Design of primary treatment System

Secondary treatment of wastewater: Concepts of Biological treatment and removal mechanism – Aerobic and Anaerobic systems - Design of suspended and attached growth processes
–Introduction to extended aeration processes and waste stabilization pond - Design of anaerobic system.

Sludge handling: Quantity and quality of sludge, Methods of sludge treatment: sludge digestion and drying beds – Disposal of sludge.

Wastewater disposal: Alternative disposal methods - Self purification of stream - Standards for disposal alternatives, natural purification of polluted streams.
House drainage & environmental sanitation: General principles – House drainage system -traps and sanitary fitting - Low cost sanitation system.

Technical tour & report: within semester visit to sewage treatment plant and prepare report.

Books:

1. Metcalf and Eddy Wastewater Engineering: Treatment Disposal Reuse, Tata McGraw Hill Ed.New Delhi, 1995.
2. G.L. Karia and R.A. Christian, Wastewater Treatment Concepts & Design Approach, PrenticeHall of India Pvt. Ltd., New Delhi, 2006.
3. Indian Expert Committee, Manual on Sewerage and Sewage Treatment, CPH and EE Organisation, Ministry of works and housing Govt. of India, New Delhi, 1991.
4. T.J. McGhee Water Supply & Sewerage", McGraw Hill International Edition, New Delhi, 1991.
5. H. S. Peavy, D. R. Row and G. Tchobanoglous, “Environmental Engineering”, McGraw Hill International Edition, New Delhi, 1995

Course No.	Course title	L	T	P/D	Hours	Credit
CE- 413	Hydraulic Structure	3	1	0	4	3

Canal head works: Layout, selection of site for diversion head work, design of weirs and barrages on permeable foundation, Bligh's creep theory, Khosla's method of independent variables, silt ejectors.

Canal falls: Necessity and location of canal falls, types, design of Sarda and Glacis falls, energy dissipation devices and arrangement.

Canal regulation works: Canal head regulators and cross regulators.

Cross drainage works: Selection, design aspects of aqueducts, siphon aqueducts, supper passages, canal siphon and level crossings.

Storage works & type of Dams: Investigation and planning for reservoirs, capacity and yield, storage works, types of dams and their choice, selection of suitable site.

Gravity dams: Two dimensional design, stability criteria and foundation treatment.

Earth dams: Design aspects, seepage through earth dams, control seepage, filters.

Arch dams: Constant angle and constant center arch dams (simple design and sketch), buttress and multiple arch dams (principle and sketch).

Spillway and stilling basins: Spillway capacity, energy dissipation below spillways, stilling basins, gates and valves aerators.

Books

1) Fundamentals of Irrigation: Bharat Singh
2) Irrigation Engineering and Hydraulics Structures: S.R.Sahasrabudhe
3) Theory and Design of Irrigation Structures Vol.I and II: R.S.Varshney
4) Irrigation Engineering and Hydraulics Structures: S.K. Garg

Course No.	Course title	L	T	P/D	Hours	Credit
CEE-414(A)	Transport Planning and Public Transport 3	3	3	1	0	4

Transportation Planning Process: Transportation as a System, Transportation and Sustainability, Elements of Transportation Planning, Urban System Components, Land Use and Transportation, Common Land use models.

Transport Demand Analysis: Nature and Analysis of Transportation Demand, Sequential Demand Analysis - Trip Generation, Trip Distribution, Modal Choice, Traffic Assignment.

Traffic Engineering: Traffic flow characteristics, traffic surveys, analysis and interpretation of traffic data, traffic regulation and control, traffic safety and management.

Public Transportation: Urban Transportation Needs, Mass Transit - Definition and classification, Transit System Operations - Service and Characteristics, Capacity and Level of Service of Urban Transit, Operational Design of Bus and Train Services.

Transportation System Management and ITS: Fundamentals of TSM, Long-range Versus TSM Planning, TSM Strategies Involving Demand and Supply, Intelligent Transportation Systems - Concept, Design, Examples.

Transportation Economics: Scope of Transportation Economics, Transportation Demand, Supply and Equilibrium, Sensitivity of Travel Demand, Factors Affecting Elasticity, Cost-Benefit Analysis of transportation projects.

Books:

1) C J Khisty and B K Lall, Transportation Engineering
2) C S Papacostas and P D Prevedouros, Transportation Engineering and Planning
3) L R Kadiyali, Traffic Engineering and Transport Planning

Course No.	Course title	L	T	P/D	Hours	Credit
CEE-414(B)	Pavement Design	3	1	0	4	3

Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements.

Stresses and strains in flexible pavements: Stresses and strains in an infinite elastic half space – use of Boussinesq's equations, Burmister's two layer and three layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors.

Flexible pavement design methods for highways and airports: Empirical, semi-empirical and theoretical approaches; Development, principle, design steps of the different pavement design methods including AASHTO, Asphalt Institute, IRC method of pavement design;

Stresses in rigid pavements: Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.

Rigid pavement design: Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, and dowel bars. IRC method of design; Design of continuously reinforced concrete pavements; Use of relevant software in flexible pavement design and concrete pavement design.

Books:

1) E.J.Yoder and M.W.Witczak, Principles of Pavement Design, John Wiley, New York
2) R.B. Mallick, Pavement Engineering: Principles and Practice, CRC Press, Boca Raton
3) Y. H. Huang, Pavement Analysis and Design, Pearson Education, Delhi

Course No.	Course title	L	T	P/D	Hours	Credit
CE-415(a)	Ground Improvement Techniques	3	1	0	4	3

Dewatering: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques - suitability and feasibility, Emerging Trends in ground improvement, methods of de-watering- sumps and interceptor ditches- single, multi stage well points - vacuum well points- Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains –Electro-osmosis.

Compaction: Principles of compaction, Engineering behaviour of compacted clays fieldcompaction techniques static vibratory, impact, Earth moving machinery, Compaction control, application to granular soils, cohesive soils, depth of improvement, environmental considerations, induced settlements, compaction using vibratory probes, vibro techniques, vibro equipment, vibro compaction and replacement process, vibro systems and liquefaction soil improvement by thermal treatment, preloading techniques, surface compaction introduction to bio technical stabilization.

Grouting: Chemical grouting, commonly used chemicals, grouting systems, grouting operations, applications, compaction grouting, application and limitations, plant for preparing grouting materials, jet grouting, jet grouting process, geometry and properties of treated soils and applications.

Stabilisation: Introduction to soil improvement by adding materials, lime, flyash, cement and other chemicals and bitumen, sand column, stone column, sand drains, prefabricated drains, lime column, soil-lime column, stabilization of soft clay or silt with lime, bearing capacity of lime treated soils, settlement of lime treated soils, improvement in slope stability, control methods.

Expansive soils: Problems of expansive soils – tests for identification – methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – under reamed piles.

Books

1) Ground Improvement: Blackie Moseley
2) Grouting in engineering Practice: R.Boweven
3) Soil Reinforcement with Geotextiles,: R.A.Jewell
4) Soil Improvement Technique and their Evolution: W.E. Van Impe

Course No.	Course title	L	T	P/D	Hours	Credit
CE-415(b)	Geosynthetics	3	1	0	4	3

Introduction: Geosynthetics, Types, Advantage and Disadvantage, Basic characteristics, Raw materials, Manufacturing processes, Functions, Selection, Physical properties, Mechanical properties, Hydraulic properties, Endurance and degradation properties, Test and allowable properties.

Applications: Retaining walls, Embankments, Shallow foundations, Roads, Unpaved roads, Paved roads, Railway tracks, Filters and drains, Slopes, Erosion control, Stabilization, Containment facilities, Landfills, Ponds, reservoirs, canals, Earth dams, Tunnels, Installation survivability requirements.

Analysis and design concepts: Design methodologies, Retaining walls, Embankments, Shallow foundations, Roads, Unpaved roads, Paved roads, Railway tracks, Filters and drains, Slopes, Erosion control, Stabilization,Containment facilities, Landfills, Ponds, reservoirs, canals, Earth dams, Tunnels.

Application guidelines: General guidelines, Care and consideration, Geosynthetic selection, Identification and inspection, Sampling and test methods, Protection before installation, Site preparation, Geosynthetic installation, Joints/seams, Cutting of geosynthetics, Protection during construction and service life, Damage assessment and correction, Anchorage, Prestressing, Maintenance, Certification, Handling the refuse of geosynthetics, Specific guidelines related to Retaining walls, Embankments, Shallow foundations, Unpaved roads, Paved roads, Railway tracks, Filters and drains, Slopes – erosion control, Slopes – stabilization, Containment facilities and Tunnels.

Quality Field Performance Monitoring and Economic Analysis: Concepts of quality and its evaluation, Field performance monitoring, Economic evaluation- Concepts of cost analysis, Experiences of cost analyses, Selected case studies.

Books

1) Geosynthetics and Their Applications by S. K. Shukla and J.H Yin
2) Geotextiles and Geomembranes in Civil Engg- Gerard P.T.M. Van Santvrot, A.A. Balkema,Oxford and IBH publishing company,New Delhi.
3) Reinforced Soil and Geotextiles -J.N. Mandal, proceedings FIGC- 1988, Oxford and IBH publishing company private Ltd.,New Delhi.
4) Geosynthetics: Application, Design and Construction- R.J. Tarmat, proceedings First Europian Geosynthetics Conference, Netherland .A.A.Balkema, Publisher-Brookfield ,U.S.A.
5) Geosynthetics World -J.N. Mandal,Willey Eastern Limited , New Delhi

Course No.	Course title	L	T	P/D	Hours	Credit
CE-415(c)	Geo Environmental Engineering	3	1	0	4	3

Waste Management Practices: Waste generation, waste quantities, Liquid, solid and hazardous waste characterization, management and disposal options of waste, Impact on environment, Geotechnical properties of solid waste.

Landfill Planning and Design Consideration: Introduction, types of landfills, site selection for landfills, site characterization, landfill layout, landfill section, landfill capacity, planning of phased operation, leachate collection facility, gas collection facility, final cover, surface water drainage, stability aspects, environmental monitoring systems, construction schedule, material requirement, equipment requirement, environmental control during operation including management of leachate and gas, landfill closure and post closure plan.

Geosynthetics in Geoenvironmental Engineering: Introduction, types of geosynthetics, functions of geosynthetics, role of geosynthetics in geoenvironmental engineering, lining system, basal lining system, side lining system, drainage blanket, surface lining, use of geosynthetics in abandoned landfills.

Natural Geotextiles in Erosion Control : Introduction, Jute and Coir production, Status of Jute and Coir industry in India, Physical and chemical characterization, Jute and Coir geotextiles, durability of jute and coir geotextiles, Test procedures, role of vegetation, erosion control products and their classification, erosion process, surface erosion control techniques, installation guide lines for slopes.

Industrial Wastes: Major Industrial and mineral wastes, Problems in utilization, Present status and future need for bulk utilization of industrial waste, Ash ponds, Slurry disposal versus dry disposal, Engineering properties of bottom ash, fly ash and pond ash, planning and design, incremental raising of height by upstream and downstream methods, closure and reclamation.

Books

1) Waste disposal in engineered landfills – Manoj Dutta
2) Geotextiles – Emerging Trends – G. Venkatappa Rao and K Balan
3) Geotechnical Engineering - C. Venkatramaiah

Course No.	Course title	L	T	P/D	Hours	Credit
CED – 416	Structural Drawing II (Steel)	0	0	3		1

Structural Drawing of steel structures: Riveted, Bolted and welded Connections, Tension members, Beams, Tension splices, Lug angle Compression member(column),Lacing and Battening, Column splices, Column Bases, Roof Trusses, Plate girders and Gantry Girder, Steel Water tanks& Staging, Steel Bridges.

Books

1) D.Krishnamurthy,Structural Design And Drawing Vol-I,II&III,CBS
2) N.KrishnaRaju,Structural Design and Drawing,Oxford University Press.
3) Murugesan&PadminiSubbarayan,Structural Drawing and Detailing,Pratheeba Publishers.
4) Subramanian,N, Design of Steel Structures, Oxford University Press, New Delhi
5) Duggal , S.K., Design of Steel Structures, Tata Mcgraw-Hill, New Delhi
6) Bhavikatti,S.S., Design of Steel Structures By Limited Method As Per Is 800-2007, I.K.International Publishing House, New Delhi
7) M.R.Shiyekar, Limit State Design in Structural Steel, PHI
8) K.S.Sai Ram,Design of Steel Structures,Pearson.
9) IS 800-2007 Is General Construction in Steel-Code of Practice,BIS.

Course No.	Course title	L	T	P/D	Hours	Credit
CED-4172	Environmental Engineering	0	0		3	3

LABORATORIES-II

1. Introduction: quality assessment of sewage & demonstration of instruments.
2. To determine the Temperature and Odor of a given sample of sewage.
3. To determine the PH value of a given sample of sewage.
4. To determine the fats, grease and oil of a given sample of sewage.
5. To determine total solid, settleable solids and volatile solids of sewage.
6. To determine nitrogen, nitrites and nitrate content in the given sewage.
7. To determine the quantity of dissolved oxygen (DO) present in the given sample.
8. To determine Bio-chemical oxygen demand (BOD) in the given sewage.
9. To determine Chemical oxygen demand (COD) exerted by the given sewage
10. To determine Total organic carbon (TOC) content in the given sewage.
11. To determine MPN of coliforms of the given sample.
12. To determine the metal & metalloids of the given sample.

Books:

1) Methods Of Sampling And Test (Physical And Chemical) For Water And Wastewater (IS:3025)
2) Standard Methods for the Examination of Water and Wastewater: APHA, AWWA,
3) Chemistry for Environmental Engg and Science: C.N. Sawyer, P.L. McCarty & G.F. Parkin
4) Eaton, A. D. Standard Methods for the Examination of Water and Wastewater.