Course Title: Hydropower Engineering (Code: CIV-801)	Syllabus for B.Tech. 8th Semester (Civil Engineering)	Total Course Credit: 4			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	Major Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	2	0

Course Outcomes:

CO1: Analyze and perform hydro power potential assessment studies.

CO2 Understand various types of hydro power developments.

CO3: Develop a knowledge related to various hydropower structures viz., canals, tunnels, penstocks, dams, spillways, etc.

CO4: Appreciate and have basic knowledge about power house details – pertinent structures, Transmission systems, and economic feasibility of hydropower plants.

S. No.	Course Contents	Contact Hours
01.	**Introduction** Introduction and historical Development, Hydropower development Power equation, Assessment of potential, Comparison of Hydropower plant and nuclear power plant	02
02	**Classification** High, medium and low Head schemes, Run off river plants, Storage power station Tidal power plant, Recent experiences, Underground Power plant. Pumped Storage Schemes, Various hydropower systems. Power demand, Role of Hydropower grid.	04
03	**Water Conveyance System** Introduction to Power Canals, Power canals, Alignment Design of Power Canals Flumes, Covered conduits and Tunnels Penstocks, Types of penstocks	02
04	**Dams** Arch dam and classification with example Buttress dam, types Design : basic principles Design of gravity dams, Numerical questions for design of gravity dam Construction of Gravity Dams Details of construction of Gravity Dams	03
05	**Embankment Dams** Introduction to embankment dams Types of embankment dams, considerations for embankment dam Introduction to Earthen dams. Rock fill dams, types of rock fill dams. Design considerations for embankment dams. Design of embankment dams	04

06	**Spillway** Introduction, uses of spillway. Types of spillway, spillway as gate. Conditions for spillway. Design of silting basin. Numerical questions	05
07	**Power House Details** Forebay, intake of a power house with general Introduction Layout of a power house, site selection for a power house. Hydropower units arrangement, underground power station	03
08	**Transmission system** Introduction to transmission system Importance and use of transmission system	04

References:

1. Arora, K.R. "Irrigation water power and Water Resources Engineering", Standard Publisher Distributors, Delhi. 2002
2. Dandekar, M.M. "Water Power Engineering" , Vikas Publishing House Gaziabad, U.P. India 1985

Course Title: Bridge Engineering (Code: CIV-802)	Syllabus for B.Tech. 8th Semester (Civil Engineering)	Total Course Credit: 3			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	Major Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	1	0

Course Outcomes:

CO1: Classify different types of bridges and demonstrate fundamental knowledge of design of bridges and understand hydrologic and hydraulic aspects of waterway bridges.

CO2: Use influence lines to calculate maximum effects (forces) due to standard moving vehicle loads prescribed in IRC Codes. Select an appropriate load system as per IRC-6 and evaluate design forces and moments in bridges.

CO3: Design the slab culvert

CO4: Design the Truss type bridges including cross beams and stringers.

CO5: Design Plate Girder Bridges both composite and non-composite.

CO6: Design slabs for all types of bridges.

S. No.	Course Contents	Contact Hours
01.	**Introduction** Historical evolution of bridges. Types of bridges. Modern trends in bridge engineering. Bridge loading standards Evolution of bridge loading standards. Indian Roads Congress bridge loading standards. Impact factors. Comparative analysis of highway loading standards. Indian Railway bridge loading standards. Track load and wheel load. Influence line diagrams Introduction to influence line diagrams Use of influence line diagrams to calculate effect of moving loads on the bridge. Influence line diagram and IRC codes. Evaluation of design loads and moment forces in bridges.	08
02	**Slab culvert** Introduction to slab culvert. General features of slab culvert. Design coefficients for flexural members. Analysis of slab decks. Design aids and tables for R/C bridge deck slabs. Design of R/C slab culvert for IRC class AA loads. Analysis and design of skew slab culvert.	10

03	**Steel Truss Bridges** Introduction to steel truss. General features of steel trussed bridges. Types of trusses. Analysis of truss frames. Design features of trusses. Design examples of truss bridges.	10
04	**Plate girder bridges.** Introduction to plate girder bridges. General features of plate girder bridges. Composite plate girder bridges and design principles. Design examples of plate girder bridges. Non composite plate girder bridges. Design principles. Design examples of non-composite plate girder bridges.	06

References:

1. Design of Bridges N. Krishna Raju Oxford and IBH Publishing House
2. Essentials of Bridge Engineering Johnson Victor, D. Oxford and IBH Publishing House
3. Design of Highway Bridges Barker RM & Puckett JA WILEY
4. Bridge Engineering Ponnuswamy, S McGraw Hill

Course Title: Rock Mechanics and Tunneling Technology (Code: CIV-801)	Syllabus for B.Tech. 8th Semester (Civil Engineering)	Total Course Credit: 4			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	Major Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	2	0

Course Outcomes:

CO1- Predict and validate the long-term strength and behavior of fractured rock

CO2-Concerned with the stability of engineering structures.

CO3-Influence of geological conditions on design and construction of tunnels.

CO4-The designing, planning, construction, maintenance and safety of tunnels.

S. No.	Course Contents	Contact Hours
01.	**Rock Mechanics** Introduction to rock mechanics and rock engineering.	06
02	Physical and Mechanical Properties of Rocks. Laboratory Testing.	03
03	Foundations and slope stability: foundations on discontinuous rock, slope instability basic mechanisms.	03
04	Rock reinforcement and rock support: underlying principles, similarities and differences. Rock Bolting.	03
05	Introduction to tunneling: Fundamental definitions, tunneling art and engineering, historical development, Classification of tunnels.	05
06	Geological aspects of tunneling: Geological investigation, evaluation and appreciation, importance of geological knowledge, aim of geological investigation, principal elements of exploration program, Influence of geological conditions on design and construction of tunnels.	08
07	Methods of Tunneling in soft and hard rock. Lining of tunnels. Tunnel supports.	05

References:

1. Brown, E.T.; Analytical and Computational Methods in Engineering Rock Mechanics, CBS Publishers and Distributors, New Delhi.
2. Goodman, P.E.; Introduction to Rock Mechanics, John Wiley & Sons.

3. Design and Construction of Tunnels: Analysis of Controlled Deformations in Rock and Soils(ADECO-RS) by Pietro Lunardi
4. Tunneling and Tunnel Mechanics: A Rational Approach to Tunneling by D. Kolymbas.
5. Introduction to Tunnel Construction (Applied Geotechnics) by David Chapman, Nicole Metje and Alfred Stärk.
6. Tunneling to the Center of the Earth: Stories (P.S.) by Kevin Wilson. Quantum Theory of Tunneling by Mohsen Razavy.

Course Title: Transportation Planning & Economics (Code: CIV-811:E1)	Syllabus for B.Tech. 8th Semester (Civil Engineering)	Total Course Credit: 4			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	Major Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	2	0

Course Outcomes:

CO1- To get to understand the basics and scope of transportation planning and transportation economics, transportation planning issues.

CO2-To learn about Public Transportation: public transport modes, desirable characteristics of public transport systems, transit system operations, route development, stopping policy, stop location, scheduling, capacity of transit systems, socially optimal pricing

CO3- To understand transport planning process, transportation and land use, transport planning strategies, transport planning models, travel demand analysis, operational transportation and land use models.

CO4- To learn transport economics and finance: pavement economics- construction cost; maintenance cost and vehicle operation cost, economic evaluation of highway projects- different methods; comparison of evaluation techniques, freight transport-trends and economic growth.

S. No.	Course Contents	Contact Hours
01.	**Transportation Planning** Scope Of Transportation Planning Scope Of Transportation Economics Transportation Planning Issues	03
02	**Public Transportation** Public Transportation: public transport modes Desirable Characteristics Of Public Transport Systems, Transit System Operations Route Development, Stopping Policy, Stop Location, Scheduling Travel Demand Analysis, Operational Transportation And Land Use Models	08
03	**Transport Analysis And Forecasting** Transport Planning Process. Transportation And Land Use. Transport Planning Strategies. Travel Demand Analysis. Growth Factor Models. Synthetic Models-1 Synthetic Models-2	12
04	**Transport Economics And Finance** Construction Cost; Maintenance Cost And Vehicle Operation Cost Economic Evaluation Of Highway Projects- Basic Principles; Time Value Of Money. Net Present Value (NPV) Method; Benefit-Cost (B/C) Ratio Method	12

	Internal Rate Of Return (IRR) Method. Freight Transport-Trends And Economic Growth	

References:

1. Transport Planning and Traffic Engineering by CA O'Flaherty, John Wiley & Sons, Inc., New York; Toronto
2. Transportation Engineering and Planning by Papacostas & Prevedouros, Prentice-Hall of India Private Ltd, New Delhi-110001
3. Principles of Transportation Engineering by Chakarborty & Das, Prentice-Hall of India Private Ltd, New Delhi-110001
4. Urban Transportation Planning by Meyer & Miller, McGraw Hill, New Delhi.

Course Title: Ground Improvement Techniques (Code: CIV-812-E2)	Syllabus for B.Tech. 8th Semester (Civil Engineering)	Total Course Credit: 4			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	Major Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	2	0

Course Outcomes:

CO1: The various aspects related to liquid, solid and gaseous waste

CO2 Quantification and projection of waste produced by communities.

CO3: Segregation and treatment of various types of wastes produced

CO4: Environmental effects of various types of wastes.

S. No.	Course Contents	Contact Hours
01.	**Introduction** Soil Types, Soil Investigation & Classification, Ground Modification/Stabilization, Need for Engineered Ground Improvement, Classification of Ground Improvement Techniques, Suitability, Feasibility and Desirability of Ground Improvement Techniques, Current & Future Developments	08
02	**Ground Improvement Techniques Mechanical Modification**: Introduction to Mechanical Modification, Principles of Soil Densification, Properties of Compacted Soil, Compaction Control, Specification of Compaction, Requirements, Types of Compaction Equipment	06
03	**Hydraulic Modification**: Objectives & Techniques, Dewatering Systems, Soil-Water Relationships, Single& Multiple-Well Formulas, Drainage of Slopes, Filtration & Seepage Control, Pre-loading & Vertical Drains, Electro kinetic Dewatering & Stabilization.	07
04	**Chemical Modification/Stabilization:** Effect of various admixtures on Engineering Properties of Soils such as: Cement, Lime, Fly ash, Bitumen, Cement Lime Fly ash. Other chemical additives such as NaCL, CaCL2 ,CaSO4 , Ca (OH)2 , NaOH etc., Grouting-Applications to Embankments, Foundations& Sensitive Soils, Admixtures in Pavement Design.	06
05	**Thermal Modification:** Thermal Properties of Soils, Heat Treatment of Soils, Ground Freezing, Strength & Behaviour of Frozen Ground. Modification By Inclusions & Confinement:	06

	Evolution of Soil Reinforcement, Applications of Geosynthetics Material in Civil Engineering, Soil Nailing, Soil Anchors, Soil Confinement by Formwork.	

References:

1. Methods of Treatment of Unstable Ground : Belt – Butterworths, 1975
2. Engineering Principles of Ground Modification: Manfired, R. H.
3. Engineering Treatment of Soils : Bell, F. G
4. Geosynthetics for Soil Improvement : ASCE, GST No. 18,New York
5. Grouting Theory & Practice : Nonveiller, E
6. Soil Stabilization : Ingles, O. G. &Metcalf, J. B.

Course Title: Earthquake Resistant Design (Code: CIV-812-E2)	Syllabus for B.Tech. 8th Semester (Civil Engineering)	Total Course Credit: 3			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	Major Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	1	0

Course Outcomes:

CO1 Introduction to some important definitions/ concepts, terminology, etc. about Engineering seismology such as origin of earthquakes, propagation of seismic waves, key ground motion characteristics in the form of response spectrum and Design response spectrum.

CO2 Response of building structures under ground motion followed by computation of seismic forces on buildings based on various methods (equivalent static method, dynamic analysis (i.e. Modal analysis) also called response spectrum method) as per IS 1893 code.

CO3 Seismic design and detailing of RCC elements as per IS 13920 code.

CO4 Seismic design of brick masonry buildings as per IS- 4326 code and repair of buildings as per IS-13935.

S. No.	Course Contents	Contact Hours
01.	Introduction to Earthquakes, Acceleration time history, Response Spectrum, Design Spectra. .	08
02	Response of buildings subjected to ground motion based on modal analysis.	06
03	Seismic design of R.C.C Structures (upto 2-Storey Buildings) based on Codal provisions IS:1893.	07
04	Seismic design of brick masonry structures based on Codal provisions.	06
05	Detailing of R.C.C. Elements as per IS:13920. Repair and seismic strengthening of buildings IS:13935	06

References:

1. Earthquake Resistant Design of buildings Manish Shirkhinde and Pankaj Agarwal
2. Earthquake Resistant Design and risk reduction David. J. Dowrick
3. Earthquake Resistant Design by James .M.Kelly
4. Earthquake resistant design of structures by S.K Duggal.