Course Title: DESIGN OF STRUCTURES-I (Code: CIV- 501)	Syllabus for B.Tech. 5th Semester (Civil Engineering)	Total Course Credit: 4			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	End-Term Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	2	0

Course Objective: To impart understanding of various aspects of design of Reinforced Concrete.

Course Outcomes:

CO1: To develop basic understanding of reinforced concrete as a construction material.

CO2: To develop understanding of various design philosophies and their differences.

CO3: To understand behavior of RCC beams.

CO4: To understand behavior of RCC members under flexural shear.

CO5: To understand behavior of compression members.

CO6: To understand behavior of two-way slabs using moment coefficient

S. No.	Course Contents	Contact Hours
01.	Properties of Concrete & Reinforcing Steel, Characteristic Strength, Stress Strain Curves, Shrinkage & Creep Phenomenon.	03
02.	General design Philosophies: Working Stress, Ultimate Load & Limit State Method of Design. Analysis & Design of Structures In Flexure/Torsion By Limit State Method.	03
03.	Design of singly and doubly reinforced sections: rectangular sections & T sections; codal provisions. Behavior of beam in shear & bond, design for shear, anchorage & slipping of reinforcement. Detailing of reinforcement as per codal provisions with reference to IS 456-2000. Serviceability limit state of deflection and cracking. Calculation of deflection, codal requirements.	18
04.	Design of columns: short and long column, eccentrically loaded columns.	05
05.	Design of one-way and two-way slabs with and without corners held down. Introduction to design by moment coefficients. Introduction to Masonry retaining walls	07

References:

1. Jain, A.K., Reinforced Concrete: Limit State Design, NEM CHAND & BROTHERS-ROORKEE; Seventh edition 2012.
2. Sinha, Reinforced Concrete Design, McGraw Hill Education; Third edition, 2017.
3. Karve & Shah, Design of R.C.C. Structures, Assorted Editorial; 8th edition 2017.
4. Kong & Evans, Design of reinforced concrete & Pre-stressed concrete Structures, CRC Press Published, 1987

Course Title: Highway Engg. And PMS (Code: CIV-502)	Syllabus for B.Tech. 5th 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: To design roads and highway alignment.

CO2: To develop geometric design of highways.

CO3: To design pavements.

CO4: To test properties of road aggregates and bituminous material.

CO5: To select materials for cement concrete roads.

CO6: To perform pavement management.

S. No.	Course Contents	Contact Hours
01.	**INTRODUCTION** Scope, History, classification of roads. Comparison with other modes of transportation	04
02.	**Alignment design:** route survey and highway Location.	03
03.	**Geometric design:** cross-section elements; sight distances, horizontal and vertical alignment	12
04.	**Pavement design:** factors affecting pavement design, types of pavements, Empirical methods of flexible pavement design (e.g. C.B.R, group index and Burmister's layer theory), stresses due to load and temperature in rigid pavements, introduction to design methods of rigid pavements.	08
05.	**Highway materials and construction**: Properties and tests for road aggregates and bituminous materials, design of bituminous concrete mix, methods of preparing sub grade, base course and construction of various types of surface covers, joints in cement concrete roads.	07
06	**Pavement management system:** basic concept, data requirements & collection methods, maintenance and rehab treatments, priority programming, implementation of PMS.	06

References:

1) Khanna, S.K. and Justo, C.E.G. 2002. “Highway Engineering”. Nem Chand Brothers, Roorkee.
2) Bhanot, K.L.1990. “ Highway Engineering”, S. Chand and Company (P) Ltd., New Delhi.
3) Rao, G.V. 1996. ”Principles of Transportation and Highway Engineering”, Tata McGraw Hill, New Delhi.
4) Pavement Design and Management Guide by Transportation Association of Canada, Ottawa, Ontario, Edn. Dr. Ralph Haas, University of Waterloo.
5) Relevant IRC Codes/Specification

Course Title: GEOTECHNICAL ENGINEERING -I (Code: CIV- 503)	Syllabus for B.Tech. 4th Semester (Civil Engineering)	Total Course Credit: 3			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	End-Term Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	1	0

Course Objective: To develop analytical and experimental skills to determine various stresses acting on soil material.

Course Outcomes:

CO1: To classify soils and understand their index properties.

CO2: To analyze flow through soils.

CO3: To perform/demonstrate soil compaction tests.

CO4: To determine stress distribution in soils.

CO5: To utilize various methods of soil investigation in field and laboratory.

S. No.	Course Contents	Contact Hours
01.	**INTRODUCTION:** Soil and its formation, various processes and agencies for formation. Types of soils. Three phase soil model, Index properties and classification of soils.	10
02.	**SOIL HYDRAULICS:** Flow through soils, Darcy's Law. Permeability, factors and determination in the lab/Field. Steady state flow, seepage force, Laplace equation for steady state flow, flow nets for homogeneous embankments with and without toe filters.	10
03.	**SOIL COMPRESSIBILITY:** One dimensional consolidation, Terzaghi's equation, Consolidation test elogp curves. Consolidation settlement, Time required for settlement. Compaction, laboratory compaction tests, proctor compaction, compaction curve and control on field compaction.	06 04
04.	**EFFECTIVE STRESS:** Total and effective stresses, pore water pressure.	02
05.	**STRESS DISTRIBUTION:** Stress distribution under concentrated load. Westergard's and Boussineq's method.	04

06.	**SOIL INVESTIGATION:** Laboratory and Field Investigation. Sub soil exploration, penetration methods, Geophysical methods electromagnetic method, electric resistivity method and Seismic method.	04
07.	**CLAY MINERALOGY:** Minerals present in clay, dependence of behaviour of clay on type 2 of mineral.	

References:

1. Alam Singh, Basic Soil Mechanics and Foundations, CBS; 1ST edition 2014.
2. D. W. Taylor, Fundamentals of Soil Mechanics, Literary Licensing, LLC 2013.
3. Karl Terzaghi, Theoretical Soil Mechanics, John Wiley & Sons, Inc, 1943.
4. Terzaghi & Peck, Soil Mechanics in Engineering Practice, 3rd Edition, John Wiley & Sons, Inc,1996.
5. Withman & Lamb, Soil Mechanics (Series in Soil Engineering), Wiley; 1 edition, 1969.
6. Soil Mechanics by S.B.Saighal
7. Alfreds R. Jumikis, Introduction to Soil Mechanics.
8. Purushothama Raj, Soil Mechanics and Foundation Engineering, Pearson; 1 edition, 2007.
9. C. Venkatramaiah, Geotechnical Engineering, New Age International; Sixth edition,2018.

Course Title: WATER RESOURCES ENGINEERING (Code: CIV- 504)	Syllabus for B.Tech. 5th Semester (Civil Engineering)	Total Course Credit: 4			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	End-Term Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	2	0

Course Objective: To impart the knowledge for understanding elementary aspects of hydrology and Fluvial Hydraulics for use in the planning, design, and management of water resources projects. Also to impart understanding of introductory aspects of integrated water resources development and management.

Course Outcomes:

CO1: To perform multiple analysis on precipitation data.

CO2: To estimate various components of hydrological cycle such as stream flow, runoff, evapotranspiration and infiltration.

CO3: To measure components of hydrological water balance in field.

CO4: To perform hydrograph analysis and estimate magnitude of flood.

CO5: To determine reservoir capacity and sedimentation.

CO6: To perform steady state analysis of groundwater movement.

CO7: To determine the technical, social and economic aspects of water resources planning and management.

S. No.	Course Contents	Contact Hours
01.	Definition and scope of hydrology, hydrological cycle, water balance equation.	02
02.	Precipitation, its mechanism, forms, weather systems, Indian scenario, measurement, average precipitation, gauge network adequacy, missing data determination, and consistency.	03
03.	Evaporation: factors affecting, measurement, empirical equations, analytical methods, reservoir evaporation; Evapotranspiration, its measurement, ET equations, potential evapotranspiration.	03
04.	Interception and depression storage.	01
05.	Infiltration, infiltration capacity, measurement, indirect determination, infiltration indices.	03

06.	Streamflow measurement: Direct and indirect methods, depth measurement, velocity measurement, stage-discharge relationship.	03
07.	Runoff: Factors affecting, runoff characteristics of streams, rainfall-runoff relationships.	02
08.	Hydrographs: Definition, components, base flow separation, effective rainfall, unit hydrograph, its derivation, applications, and limitations.	03
09.	Floods: Rational method, empirical methods, U.H. method, Design flood definition.	02
10.	Flood routing: Reservoir and channel routing.	03
11.	Reservoir Design Studies: Types of reservoirs, storage capacity, fixation of capacity, safe yield, reservoir sedimentation: trap efficiency, capacity-inflow ratio, life of reservoirs.	03
12.	Groundwater: Introduction, types of aquifers, aquifer properties, Darcy's law, Dupuit assumptions, steady one-dimensional aquifer flow, Well Hydraulics: Steady flow to wells in confined and unconfined aquifers.	03
13.	Fluvial Hydraulics: Introduction, properties of sediment particles, brief description of incipient motion, bed load, and suspended load.	03
14.	Water Resources Planning and Development: National water policy, Single and multi-purpose development, Integrated water resources development and management, inter-state and international aspects of river basin development.	02

References:

1. Subramanaya, K. "Engineering Hydrology" Tata McGraw Hill, New Delhi, 2001.
2. Linsely, K., Kohler, A. and Paulhus L.H. "Hydrology for Engineers" McGraw Hill Book Company Inc. New York, 1975.
3. Ragunath, H.M. "Hydrology Principles Analysis and Design" New Age International (P) Ltd Publishers., New Delhi, 2005.
4. Garde, R.J. and RangaRaju K.G. "Mechanics of sediment transportation and alluvial stream problems". New Age International (P) Ltd. Publishers, New Delhi, 1994.
5. Arora, K.R. "Irrigation Water power and water Resources Engineering". Standard Publishers Distributors, Delhi, 2002.
6. Wilson, E.M. "Engineering Hydrology" ELBS, English Language book Society/ Macmillam Education Ltd., London, 1999.
7. Asawa, G.L. Irrigation and Water Resources Engineering, New age International Publishers, 2005.

Structural Analysis – III (Code: CIV- 501)	Contact Hours = 42	Total Course Credit: 4			
Mid-Term	Class Assessment	End-Term	L	T	P
30 Marks	10 Marks	60 Marks	3	1	0

Course Objective: To learn the method of drawing influence lines for determinate and indeterminate structures. The students are expected to analyze the arches and suspension bridges and learn the plastic analysis of beams and rigid frames.

Course Outcomes:

CO1: Draw influence lines for statically determinate structures and calculate critical stress resultants.

CO2: Understand Muller-Breslau principle and draw the influence lines for statically indeterminate beams.

CO3: Analyze three hinged, two hinged and fixed arches.

CO4: Analyze the suspension bridges with stiffening girders.

CO5: Understand the concept of Plastic Analysis and the method of analyzing beams and frames.

S. No.	Contents	Contact Hours
01.	**Influence Line Diagrams for Determinate Structures:** Influence lines for reactions in statically determinate beams, Girders with floor systems, Trusses: ILD for deflections. Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment – influence lines for member forces in pin jointed plane frames. Muller-Breslau Principle	10
02	**Arches** – Types of arches – Analysis of three hinged, two hinged and fixed arches – Parabolic and circular arches – Rib shortening and temperature effects.	8
03.	**Cables and Suspension Bridges:** Statics of a suspension cable. Analysis of cables and suspension bridges with and without stiffening girders. Influence lines for three hinged stiffening girders.	8
04.	**Plastic Analysis:** Plastic theory, Plastic Section Modulus, Shape factor and Moment of resistance, Plastic hinge and Mechanism – Collapse load – Static and Kinematic methods- Upper and Lower Bound Theorems – Plastic Analysis of Indeterminate beams and frames including Gable Frames. Plastic moment distribution for multi-storey and multi-bay frames.	10
05.	**Influence Line Diagrams for Indeterminate Structures:** - Influence lines for shear force, bending moment and support reaction components of beams, arches. Development of force envelope.	6

Textbooks:

1. Hibbeler, R. C. (2002). *Structural Analysis*, Pearson Education (Singapore) Pt. Ltd., Delhi
2. Leet, K. M. and Uang, C-M. (2003). *Fundamentals of Structural Analysis*, Tata McGraw-Hill Publishing Company Limited, New Delhi.

3. V.K. Manicka Selvam: Fundamentals of Limit Analysis of Structures (A Course in Plastic Analysis of Structures), Dhanpat Rai Publications.

References:

1. C. S. Reddy, 'Basic Structural Analysis', Tata McGraw Hill, New Delhi.
2. C.K. Wang, 'Intermediate Structural Analysis', Tata McGraw Hill, New Delhi.
3. Junnarkar.S.B. and Shah.H.J, "Mechanics of Structures", Vol II, Charotar Publishing House, New Delhi 2016.

Course Title: CONCRETE TECHNOLOGY (Code: CIV-506:E1)	Syllabus for B.Tech. 3rd Year (5th 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 Objective: To impart understanding of various aspects related to ingredients and properties of concrete and concrete mix design.

Course Outcomes:

CO1: Understand properties and role of ingredients like cement, aggregate etc. to produce better quality concrete
CO2: Understand the behavior of fresh and hardened concrete.
CO3: Apply design mix to produce concrete with adequate strength
CO4: Understand the need for special concrete

S. No.	Course Contents	Contact Hours
01.	Cement: Its Basic Chemistry, Types of Portland cement	05
02.	Normal aggregates and their properties	05
03.	Fresh Concrete and its properties. Strength of Concrete: Water/Cement ratio-Gel/Space Ratio, Influence of Temperature on Strength of Concrete and Bond between concrete and Reinforcement, Mixing, handling, placing, and Concrete. Elasticity, Shrinkage and Creep of Concrete	18
04.	Mix Design: IS method	05
05.	Special Concretes	05

References:

1) Neville, A.M. "Properties of Concrete. Pearson Publishers, New Delhi, 2004
2) Shetty, M.S. "Concrete Technology" S.Chand& Company New Delhi, 2002
3) Gambhir,M.L. " Concrete Technology" TaTa McGraw Hill New Delhi, 1995
4) Neville, A.M. and Brookes, J.J." Concrete Technology", Pearson. 1994

Course Title: ENGINEERING SEISMOLOGY (EARTHQUAKE ENGINEERING) (Code: CIV- 506:E1)	Syllabus for B.Tech. 5th Semester (Civil Engineering)	Total Course Credit: 3			
Midterm Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	End-Term Examination	L	T	P
30 Marks	10 Marks	60 Marks	2	1	0

Course Objective: To impart the basic understanding of earthquakes, physics of the earth's interior from a practical side, to foresee the potential consequences of strong earthquakes on urban areas and civil infrastructure and how to do more efficient hazard management and mitigation. This module will communicate how science can enhance community resilience and has relevance far beyond any site for earth sciences, earthquake engineering, preparedness, mitigation, emergency response, decision- making, and public policy.

Course Outcomes:

CO1: Properties of the Earth's interior, physical characteristics of seismic sources, Estimation of seismic hazard and risk

CO2: Effects of earthquakes on humans, objects and surroundings.

CO3: Information on the soil structure and properties at the construction site, as well as on the path between epicentre and the site

CO4: Parameters needed in order to construct seismically safe and sound structures.

S. No.	Course Contents	Contact Hours
01.	Engineering Seismology, Seismology and Seismic Exploration (Definitions). Introduction to Seismic Hazard and Earthquake Phenomenon. Global seismicity - Analysis of earthquake focal mechanisms.	06
02.	Seismotectonic and Seismic Zoning of India. Micro-zonation. Mechanism of Faulting. Earthquake Prediction.	07
03.	Site Response to Earthquakes: Local geology and soil conditions. Site investigations and soil tests. Dynamic design criteria for a given site.	08
04.	Earthquake Monitoring and Seismic Instrumentation. The Seismograph – Principles of Seismometer. Location of the epicenter of an earthquake. Earthquake size and intensity. Energy released in an earthquake.	08

05.	Earthquake: Risk and Preparedness. Earthquake: Social Consequences; Codes and Public Policy.	08

References:

1. Bolt, B.A., W.H. Freeman, Earthquake, New York, 1993.
2. Kearey P and Brooks, An Introduction to Geophysical by Exploration, M. Blackwell Publishers Oxford, 1991.
3. Robinson, E.S and Coruch, Basic Exploration Geophysics, C. John Wiley & Sons, 1998.
4. Walker, B.S., Earthquake Time-Life Books Inc., Alexandria, Virgina, 1982.
5. Bott, M.H.P., Edward Arnold, The Interior of the Earth. London, 1982.
6. Flower, C.M.R, The Solid Earth: An Introduction to Global Geophysics., Cambridge University Press, 1990.
7. Lay, T. and Wallace, T.C, Modern Global Seismology., Academic Press, San Diego, 1995.