

**BMS COLLEGE OF ENGINEERING**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**SCHEME OF TEACHING AND EXAMINATION 2016-2017**  
**V SEMESTER B.E**

Course Code	Course Title	Teaching Department	Credits				Credits	Contact Hours/week	CIE marks	SEE marks	TOTAL MARKS
			L	T	P	S					
16CV5DCISA	Indeterminate Structural Analysis (core)	CIVIL	3	1	-	-	4	5	50	50	100
16CV5DCWSE	Water Supply Engineering(core)	CIVIL	1	1	-	-	2	3	50	50	100
16CV5DCFEN	Foundation Engineering (core)	CIVIL	3	-	1	2	6	5	50	50	100
16CV5DCHEN	Highway Engineering (core)	CIVIL	3	-	1	2	6	5	50	50	100
16CV5DCHWR	Hydrology &Water Resources (core)	CIVIL	3	-	-		3	3	50	50	100
16CV5DCCDL	Cad Lab (core)	CIVIL	-	-	1	-	1	2	50	50	100
16CV6DE---	Department Elective DEC- 1	CIVIL	3	-	-	-	3	3	50	50	100
			Total				<b>25</b>	<b>26</b>			<b>700</b>

L- Lecture Hours/Week, T- Tutorial -2Hours/week, P- Practical- 2 Hours/week. S-Self Study

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**DEPARTMENT ELECTIVES**

Subject Code	Course Title	Teaching Department	CREDITS				Contact Hours
			L	T	P	Total	
DEC-1							
16CV5DEACT	Advanced Concrete Technology	CIVIL	2	-	1	3	4
16CV5DEAPL	Air Pollution	CIVIL	3	-	-	3	3
16CV5DEABM	Alternative building materials and technology	CIVIL	3	-	-	3	3
16CV5DEDMM	Disaster Management and Mitigation	CIVIL	3	-	-	3	3
16CV5DEGWC	Global Warming and Climate Change	CIVIL	3	-	-	3	3

The student shall select any one of the courses as an elective (DEC-1)

**V SEMESTER CIVIL ENGINEERING  
INDETERMINATE STRUCTURAL ANALYSIS**

Course Name	Indeterminate Structural Analysis	Course Code	16CV5DCISA	SEE Duration	SEE+CIE
Credits	4	L-T-P-S	3:1:0:0	3 Hours	50+50

**COURSE OBJECTIVES:**

After gaining knowledge on the fundamental structural analysis of simple structures like arches, suspension cables, analysis of simple beams and frames, the present course enable the students to analyze higher order structures with more redundancies.

**COURSE OUTCOMES:**

**CO1:** Develop relevant equations for Displacement method and applying the same for analysis on structures for different loading and boundary conditions.

**CO2:** Develop conditions for Force method and applying the same for analysis on structures with different load and boundary conditions.

**CO3:** Analyze beams for shear force and bending moment for rolling loads and use of influence line diagrams.

**Slope Deflection Method:**

Introduction, Development of slope-deflection equations, Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid). **08 Hours**

**Moment Distribution Method (Without Sway):**

Introduction- Distribution factor, Carry over factor. Development of method. Analysis of beams and orthogonal rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid) **08 Hours**

**Moment Distribution Method (With Sway)**

Analysis of rigid jointed plane frames (sway, members assumed to be axially rigid and kinematic redundancy  $\leq 3$ ). **07 Hours**

**Kani's Method**

Introduction, Basic Concept, Analysis of Continuous beams, Analysis of rigid jointed sway and non-sway plane frames. **04 Hours**

**Flexibility Matrix Method of Analysis:**

Introduction, Axis and co-ordinates, Development of flexibility matrix for plane truss element and axially rigid plane framed structural elements. Analysis of plane truss and axially rigid plane frames by flexibility method with static indeterminacy  $\leq 3$  using transformation matrix. **05 Hours**

**Stiffness Matrix Method of Analysis:**

Introduction, Axis and Co-ordinates, Development of stiffness matrix for plane truss element and axially rigid, plane, framed structural elements. Analysis of plane truss and axially rigid plane frames by stiffness method, with kinematic indeterminacy  $\leq 3$  using transformation matrix. **14Hours**

**Rolling Load and Influence Lines:**

Rolling load analysis for simply supported beams for several point loads and UDL. Influence line diagram for reaction, SF and BM at a given section for the cases mentioned above. **06 Hours**

**Text Books:**

Reddy C.S., "Basic Structural Analysis", Third Edition, Tata McGraw Hill Publication Company Ltd. 2010

S.P. Gupta, G.S. Pandit and R. Gupta, "Theory of Structures Vol. 2", I Edition, Tata McGraw Hill Publication Company Ltd. 1999

**Reference Books:**

J. Sterling Kinney, "Indeterminate Structural Analysis", Oxford and Publishing Co.

Noris C.H., Wilbur J.B., "Elementary Structural Analysis", I Edition, Mc Graw Hill International Book Edition.

C.K. Wang, "Intermediate Structural Analysis", Mc Graw Hill Publications.

Ashok K. Jain, "Advanced Structural Analysis", 3rd Edition, Nem Chand & Bros., Roorkee, India.

**e-resource:**

[nptel.ac.in/courses/105101086/](https://nptel.ac.in/courses/105101086/)-NPTEL

## V SEMESTER CIVIL ENGINEERING

### WATER SUPPLY ENGINEERING

Subject	Water Supply Engineering	Sub. Code	16CV5DCWSE	SEE Duration	SEE+CIE
Credits	02	L-T-P Hours/ week	1:1:0	3 hrs	50 + 50

#### Course objective:

To provide fundamental knowledge to students about water demand, sources, conveyance, quality, treatment and its distribution.

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#### Course outcome:

**CO1:** Describe and design various parameters of collection and conveyance of water

**CO2:** Evaluate water quality parameters through experiments

**CO3:** Describe basic structure of drinking water supply systems and design the component systems of water treatment facilities

**Introduction:** Human activities and environmental pollution, requirement of water for various beneficial uses, Need for protected water. **02 hours**

**Demand of Water:** Types of water demands-domestic demand, institutional and commercial, public uses, fire demand. Per capita consumption-factors affecting per capita demand, population forecasting, different methods with merits and demerits-variations in demand of water., estimation of fire demand using various formulas, peak factors, design period and factors governing the design periods **05 hours**

**Sources, Collection and Conveyance of Water :** Surface and Subsurface sources-suitability with regard to quality and quantity.

Intake structures-different types of intakes; factors for selection and location of intakes. Pumps-Necessity, types-Power of pumps; factors for the selection of a pump. Pipes-Design of the economical diameter of rising main; Nomograms-Use; Pipe appurtenances. **05 Hours**

**Quality of Water:** Objectives of water quality management. Concept of safe water, Whole someness & palatability, water borne diseases. Examination of water: Objectives-physical,chemical,microbiological and radiological Examinations, (BIS 3025 and BIS 1622) using analytical and instrumental techniques. Drinking water standards BIS and WHO guidelines. Health significance of Fluoride, Nitrate and heavy metals like mercury, cadmium and Arsenic. Sampling water for examination **05 Hours**

**Water Treatment methods :** Objectives- Treatment flow-chart. Aeration-Principles, types of Aerators.

**Sedimentation:** Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test, chemical feeding, flash mixing and clariflocculator.

**04 Hours**

**Filtration and Disinfection;** Mechanism-theory of Filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design-excluding under drainage system-back washing of filters. Operational problems in filters. Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV rays. Treatment of swimming pool water. **06Hours**

**Softening and Miscellaneous Treatment :** definition methods of removal of hardness by lime soda process and zeolite process RO and membrane technique. Removal of color, odor, taste, Adsorption techniques, Fluoridation and Defluoridation. **03 Hours**

**\*\*Site Visit to water Treatment plant.**

**Text Books:**

1. Water supply Engineering-S.K.Garg , Khanna Publishers, 2015
2. Water supply engineering-B.C.Punmia, Arihant publicatoions, 2016

**Reference Books:**

1. Elements of Public health engineering-K.N.Duggal, S.Chand & Co
2. Manual of water supply and treatment-CPHEO publication
3. Water and Waste water Technology-Mark.J.Hammer,John wiley and sons.
4. Water supply and sewerage-E.W.Steel and T.J.Mc.Ghee,Mc.Graw hill publication.

## V SEMESTER CIVIL ENGINEERING

### FOUNDATION ENGINEERING

Course name	Foundation Engineering	Sub Code	16CV5DCFEN	SEE duration	SEE +CIE
Credits	6	L-T-P-S Credits	3: 0: 1: 2	3 hours	50+50

#### **Course objective:**

To enable the students to apply the knowledge of basics of soil mechanics for safe design of civil engineering structures such as foundations, retaining walls, and also to assess the stability of slopes.

#### **Course Outcomes:**

An ability to

**CO1:** Compute consolidation and settlement characteristics of soil.

**CO2 :** Determine lateral Earth pressure on retaining walls for its safe design

**CO3 :** Analyze stability of soil slopes; and suggest slope protection measures

**CO4 :** Suggest and plan various soil exploration techniques, and also estimate the state of stress below any type of loaded area

**CO5:** Evaluate bearing capacity of soil to design a shallow foundation and Explain safety measures and regulations for soil excavation.

**CO6:** Perform experiments to evaluate various soil properties

**Consolidation of Soils:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations. Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $c_v$ ), Time rate of consolidation, Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Laboratory one dimensional consolidation test, -Determination of compression index. Consolidation settlement, numerical problems **8 hours**

**Lateral Earth Pressure:** Introduction to soil erosion, Retaining walls-Importance - Active and passive earth pressures, Earth pressure at rest, determination of Active and passive Earth pressure coefficient for  $C=0$  soil and cohesive soils. Safe depth of excavation without lateral support, Earth pressure theories- Rankine's and Coulomb's -assumptions and limitations, safe design of retaining wall, numerical problems **8 hours**

**Stability of Earth Slopes:** Introduction, Types of slopes, causes and types of slope failures. factors of safety, Stability of slopes- analysis by Method of slices, Fellenius method of locating centre of critical slip circle, Taylor's stability number, stability of earthen dams, vertical cut safe depth, numerical problems

**Soil conservation :** Soil erosion, types, conservation practices – slope protection by retaining walls, bunds and other methods, soil erosion estimation **8 hours**

**Subsurface Exploration:** Objectives of exploration program, Methods of exploration: Trial pits, boring. Number and depth of borings for building and dams, Types of samples- undisturbed, disturbed and representative samples. Types of Samplers, Sample disturbance, Area ratio, Recovery ratio, Standard penetration test, Typical boring log, geophysical methods, modern instruments and techniques.

**Stresses In Soils:** Boussinesq's theory for concentrated loads, –line load, strip loads, circular loading --numerical problems. Rectangular loading: exact method, approximate method for point at centre, & corner (No derivation of equations), pressure bulb, Westergaards theory, contact pressure **8 hours**

**Bearing Capacity of soils:** Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's bearing capacity equations- assumptions and limitations, estimating bearing capacity of footings subjected to vertical loading, factor of safety. IS Code method, Effect of ground water table on bearing capacity. Correlation of Standard penetration test N-values with bearing capacity of soil, plate load test, types of settlement, numerical problems, modulus of subgrade reaction

**Excavation and trenches-** soil excavation- introduction, methods, excavation hazards, OSHA safety requirements **8 hours**

### **Text Books**

1. Punmia B.C. (2005), 'Soil Mechanics and Foundation Engg.', 16th Edition, Laxmi Publications Co. , New Delhi.
2. Braja M. Das (2013), "Principles of Geotechnical Engineering", 5th Edition, Thomson Business Information India (P) Ltd., India.
3. Venkatramiah,(2016) soil mechanics and foundation engineering, New age int. (p) ltd.



## **Reference Books/Codes:**

1. Bowles J.E. (2001), "Foundation Analysis and Design" 5th Edition, McGraw Hill Pub. Co. New York.
2. Bowles J.E. (2001), "Engineering Properties of Soil and Their Measurements", 4<sup>th</sup> edition, McGraw Hill Book Co. New York.
3. Craig R.F. (2008), "Soil Mechanics", 8th edition, Spon press, New York.
4. Gopal Ranjan and Rao A.S.R. (2006), "Basic and Applied Soil Mechanics", revised 2<sup>nd</sup> edition, New Age International (P) Ltd., New Delhi.
5. Head K.H., (2006), "Manual of Soil Laboratory Testing", 3<sup>rd</sup> Edition, Whittles Publishing, UK.
6. Lambe T.W. (1966), "Soil Testing for Engineers", John Wiley & Sons., New Jersey, USA.
7. Terzaghi. K. and Peck. R.B. (2009) "Soil mechanics in Engineering practice", 3<sup>rd</sup> Edition, Wiley India Pvt Ltd, New Delhi.
8. Relevant B.I.S codes, ASTM and BS codes.

## **E Learning resources:**

- 1) [ocw.mit.edu](http://ocw.mit.edu) > Courses > Civil and Environmental Engineering
- 2) <http://www.myopencourses.com/subject/e-book-on-concepts-and-techniques-in-geotechnical-and-foundation-engineering>
- 3) <http://nptel.ac.in/syllabus/syllabus.php?subjectId=105107120>
- 4) <http://nptel.ac.in/syllabus/syllabus.php?subjectId=105101084>

## **List of laboratory experiments on soil**

1. Determination of Water content by oven drying method and pycnometer method
  2. Determination of specific gravity by density bottle and pycnometer method
  3. Determination of in situ density by sand replacement and core cutter method
  4. Determination of liquid limit, plastic limit and shrinkage limit.
  5. Determination of grain size distribution by sieve analysis.
  6. Determination of permeability of coarse grained and fine grained soil
  7. Determination of shear parameters by conventional Direct shear test
  8. Determination of shear parameters by Unconfined compression test
  9. Determination of shear parameters by Triaxial shear test
  10. Determination of OMC and MDD by Standard proctor test
- Modern tools: Digital shear testing equipments

## V SEMESTER CIVIL ENGINEERING

### HIGHWAY ENGINEERING

Course name	Highway Engineering	Sub Code	16CV5DCHEN	SEE duration	SEE +CIE
Credits	6	L-T-P-S	3: 0: 1: 2	3 hours	50+50

#### Course objective:

To provide knowledge of highway materials and methods for design and construction of highways

#### COURSE OUTCOMES:

An ability to:

- CO 1 Identify and Prioritize highway proposals for road development and decide the route alignment
- CO 2 Analyse and design the components of horizontal and vertical alignment of highways as per IRC specifications
- CO 3 Apply knowledge on properties of highway materials in conducting various laboratory tests and preparing reports
- CO 4 Analyse and design highway pavements and highway drainage
- CO 5 Select and analyze different materials required for road construction

**INTRODUCTION:** Role of Transportation Engineering, Characteristics of Road Transport, Scope of highway engineering. **02 Hours**

**HIGHWAY PLANNING:** Necessity of highway planning, Classification of Roads, Road patterns, Planning Surveys-Interpretation of plans-Preparation of Master plans-Phasing of plan, Lucknow Road Development Plan-Problems, Road Development Plan:Vision-2021, Rural Road Development Plan:Vision-2025. **04 Hours**

**HIGHWAY ALIGNMENT AND SURVEYS:** Requirements-Factors controlling Alignment-Surveys for highway alignment, Highway Projects- Drawings and Reports **04 Hours**

**GEOMETRIC DESIGN:** Importance, Design Controls and Criteria, Highway cross sectional elements, Sight Distance requirements, Design of Horizontal Alignment, Design of Vertical Alignment-Problems. **07 Hours**

**HIGHWAY MATERIALS:** Soil Subgrade, Soil Classification-BIS and HRB methods, Plate load test-Problems, Road Aggregates-Desirable properties, Bituminous Binders-Paving Grade Bitumen, Modified Bituminous Binders, Cut-back Bitumen and Bitumen Emulsion-Characteristics and Types. **06 Hours**

**PAVEMENT DESIGN:** Introduction to Flexible and Rigid pavements, Design of Flexible Pavement by CBR Method (CSA), Design of Rigid pavements by Westergard's Stress Analysis-Wheel Load Stresses-Temperature stresses, Problems on above. **07 Hours**

**HIGHWAY CONSTRUCTION:** Construction of Pavements- on Embankment and in Cutting, Base Course Construction-Wet Mix Macadam, Bituminous Macadam, Surface Course Construction-Bituminous Concrete, Cement Concrete. **04 Hours**

**HIGHWAY DRAINAGE:** Objects-Surface and Sub-surface Drainage-Design of Surface Drainage System-Problems. **03 Hours**

**HIGHWAY ECONOMICS AND FINANCE:** Introduction to Highway user benefits, Economic Analysis and Highway Finance in India-A Case Study. **02 Hours**

**Text Books:**

S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.

S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Materials and Pavement Testing", Revised 5th Edition, Nem Chand and Bros, Roorkee, 2013.

**Reference Books:**

R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press (India) Private Ltd., 2012.

S. P. Bindra, "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Revised Edition, 2013.

**MOOCs:** <https://www.nptel.ac.in/courses/105101087/>

**EXPERIMENTS/EXERCISES**

**Tests on Subgrade Soil:**

Modified Compaction Test

California Bearing Ratio Test

**Tests on Road Aggregates:**

Aggregate Impact Test

Los Angeles Abrasion Test

Aggregate Crushing Value Test

Specific Gravity Test and Water Absorption Test

Shape Tests

Flakiness Index

Elongation Index

Angularity Number

**Tests on Bituminous Materials:**

Penetration Test

Ductility Test

Softening Point Test

Specific Gravity Test

Viscosity Test

Flash and Fire Point Test

Tests on Bituminous Mixes

Marshall Stability Test

**V SEMESTER CIVIL ENGINEERING  
HYDROLOGY AND WATER RESOURCES**

<b>Course name</b>	<b>Hydrology and water resources engineering</b>	<b>Sub Code</b>	<b>16CV5DCHWR</b>	<b>SEE duration</b>	<b>SEE +CIE</b>
<b>Credits</b>	<b>3</b>	<b>L-T-P-S</b>	<b>3: 0: 0: 0</b>	<b>3 hours</b>	<b>50+50</b>

**COURSE OBJECTIVE:** To provide knowledge to students about causes, occurrence and estimation of rainfall and runoff

**Course outcomes:**

**Ability to:**

CO1: Describe hydrologic cycle and Analyse the rainfall data

CO2: Compute the losses from precipitation.

CO3: Estimate the runoff from a watershed

CO4: Explain methods for measurement of stream flow and steady radial flow into wells

**Hydrologic Principles:** Introduction, Hydrologic cycle, Importance of Hydrology. Global water availability. India's water availability. Practical applications of Hydrology, Hydrologic cycle (Horton's qualitative and engineering representations). **3 Hours**

**Precipitation:** Weather systems, Forms and types of precipitation, Measurement of rain fall using Symon's and Siphon type of rain gauges, Optimum number of rain gauge stations, Consistency of rainfall data (double mass curve method), Computation of mean rainfall arithmetic average, Thiessen polygon and Isohyet methods, Estimation of missing rainfall data (Arithmetic average, normal ratio and regression methods). Presentation of precipitation data -moving average, mass curve, rainfall hyetographs, intensity - duration - frequency curves. **10 Hours**

**Losses from precipitation:** Evaporation: process, factors affecting Evaporation, measurement using IS Class A Pan, Estimation using empirical formulae. Infiltration: factors affecting infiltration capacity, measurement (double ring infiltrometer). Horton's infiltration equation, infiltration indices. **10 Hours**

**Runoff:** Concept of catchment/ watershed, Water budget equation, components, Factors affecting runoff. Rainfall - runoff relationship using simple regression analysis, SCS Curve Number Method, Hydrographs, Unit Hydrograph method. **7 Hours**

**Stream Flow Measurement:** Measurement of stage, measurement of discharge by Area – Velocity method and slope area method, Simple stage discharge relation **5 Hours**

**Well Hydraulics:** Aquifer parameters, Steady radial flow into wells in unconfined and confined aquifers. Types of wells, Methods of construction. **4 Hours**

**Text Books:**

A Text Book of Hydrology- Jayarami Reddy, Lakshmi Publications, New Delhi.  
Edition :Third, 2016

**Reference Books:**

Hydrology- H.M. Raghunath, Wiley Eastern Publication, New Delhi.

Hand Book of Hydrology- Ven Te Chow , Mc Graw Hill Publications.

Hydrology and Water Resources Engineering- R.K. Sharma and Sharma. Oxford and IBH, New Delhi.

Hydrology and Water Resources Engineering- Garg S.K., Khanna Publishers, New Delhi.

Applied Hydrology- Linsley, Kohler and Paulhus, Wiley Eastern Publication, New Delhi.

Ground Water Hydrology- Todd, Wiley Eastern Publication, New Delhi.

e- learning :

<http://ocw.tudelft.nl/courses/watermanagement/hydrology-of-catchments-rivers-and-deltas/lectures>

<http://nptel.ac.in/syllabus/105107129>

<http://nptel.ac.in/syllabus/105101002/>

**V SEMESTER CIVIL ENGINEERING  
CAD LABORATORY**

Course Name	CAD Lab	Course Code	16CV5DCCDL	SEE Duration	SEE+CIE
Credits	01	L-T-P-S Credits	0:0:1:0	02 Hours	50+50

**COURSE OBJECTIVES:**

To enable students to gain drafting skills and visualize the various components of a building. This will enable students to design the buildings based on the given functional requirements.

**COURSE OUTCOMES:** An ability to use CAD to:-

**CO1:** Prepare drawings of various components of a building.

**CO2:** Prepare functional drawings for buildings as per norms.

1. Introduction to Auto CAD: **2 Hours**
2. To prepare the drawing of components of building- Wall footing and RCC Column footing, Doors & windows (Fully paneled door & glazed window) **4 Hours**
3. Stair case drawing, Lintel and chajja **3 Hours**
4. Drawing of plan, elevation, section & schedule of openings of single bed room house, two bedroom houses. **3 Hours**

**Text Books:**

"Building Drawing" by Shah M. H. And Kale C. M., Tata McGraw Hill Publishing Co.

**REFERENCE BOOKS:**

1. Auto CAD Manual
2. "A Course in Civil Engineering Drawing", by V. B. Sikka, S. K.Kataria & Sons, 7th Edition:2015.
3. "Building Construction", Gurucharan Singh, Standard publication IS: 962- Code of practice for architecture and building drawing National Building code, BIS, New Delhi.

## ELECTIVES

### V SEM CIVIL ENGINEERING DEPARTMENT ELECTIVE ADVANCED CONCRETE TECHNOLOGY

Course Name	Advance concrete technology	Course Code	16CV5DEACT	SEE Duration	SEE+CIE
Credits	02+01=3	L-T-P-S Credits	2:0:1:0	03 Hours	50+50

#### Course Outcomes

An ability to

**CO1: Explain conventional concrete and their constituents**

**CO2: Analyse different types of special concretes and mix design procedures**

**Brief Review of Conventional Concrete and Constituent Materials:** Brief Introduction of Concrete including composite cement and properties, Waste Materials in Concrete: Introduction to waste material including construction and demolition waste, glass, plastic, rubber and recycled concrete. Requirement of concrete for pumping.

**Self Compacting Concrete:** Brief history of development, Definition, Fresh property requirements, Tests as per EFNARC and ASTM, Mix design procedures, Comparison of hardened properties with conventional concrete, Applications, Economical aspects.

#### **Rheology of Concrete**

Introduction, Factors affecting the rheology of fresh concrete, Constitutive equation for measuring the rheological properties and the measuring instruments.

**Fiber Reinforced Concrete:** Fibers, types, characteristics, Fiber distribution, orientation and interfacial bond. Mechanical properties of FRC mix design of FRC, behavior of hardened FRC under compression, tension flexure and impact, SIFCON, Ductal Concrete.

**High Performance Concretes:** Concept, materials selection, mineral admixture, proportioning, strength, and durability aspects, Construction & economical Aspects, codal provisions, Applications and their performance. Light Weight and High Density Concrete: Definition, Proportioning, Properties and Applications

**Geo-polymer Concrete:** Brief history of development, Definition, Reaction chemistry, material characterization, mix proportioning, properties and applications

**Reference Books:**

1. Fiber Reinforced cement composites, by Perumalsamy.N Balaguru and surendra P.Shah, McGraw Hill International edition, Civil Engineering series.
2. Concrete technology and Design-vol.1& 2: New concrete materials by R N Swamy.
3. Self-Compacting Concrete by Geert De Schutter, Peter J.M.Bartos and Peter Domone, Whittles Publishing
4. Current Literatures
5. Concrete Technology by Dr. Aminul Islam Laskar, University Science Press.
6. Advanced Concrete Technology –Process by John Newman and Ban Seng Choo, ISBN 0 7506 5105 9, Elsevier Ltd.
7. Properties of Concrete, A.M.Neville, Pearson Education (Singapore) Pte. Ltd.,
8. Concrete Microstructure, Properties, and Materials, by P.Kumar Mehta and Paulo J.M.Monteiro.

**LABORATORY :**

## List of Experiments

1. Mix design of concrete as per IS, ACI & BS methods for various strength requirements.
2. Characterization of Blended Cement
3. Determination of Optimum Dosage of HRWA by marsh cone test.
4. Tests on Self Compacting concrete.
5. Mix design of Geo-polymer concrete.



**V SEM CIVIL ENGINEERING  
DEPARTMENT ELECTIVE  
ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGY**

<b>Course Name</b>	<b>Alternative building materials and technology</b>	<b>Course Code</b>	<b>16CV5DEABM</b>	<b>SEE Duration</b>	<b>SEE+CIE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S Credits</b>	<b>3:0:0:0</b>	<b>03 Hours</b>	<b>50+50</b>

**COURSE OBJECTIVES:**

To Introduce the students to the concept of low-energy and low-cost building, locally available materials and technologies

**COURSE OUTCOME:**

An ability to:

CO1: Explain Energy concepts, environmental concerns for building materials and green building ratings

CO2: Classify and explain alternate masonry units and various types of waste materials used for building construction

CO3: Discuss properties, applications of fiber reinforced concrete and ferro cement

CO4: Suggest cost effective design of buildings and describe different kinds of alternate roofing systems

**INTRODUCTION:**

**9 HOURS**

Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture, Green building ratings – IGBC and LEED manuals – mandatory requirements.

**ALTERNATIVE MASONRY UNITS:**

**8 HOURS**

Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks: mud blocks, steam cured blocks, Fal-G Blocks, stone masonry block, Equipments used for production of stabilized blocks,

**BUILDING MATERIALS FROM AGRO AND INDUSTRIAL WASTES:**

Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Field quality control test methods

**OTHER MISCELLANEOUS MATERIALS** : Different materials used as alternatives such as, Aluminum, Bitumen Materials, Soil Conditioning Agents, Tempered Glass, Crumb Rubber, Fibre Reinforced Polymer, Glass Fibre, Reinforced Plastics, Bamboo reinforced plastics etc., their properties and sustainability, Lime-pozzolana cements- Raw materials, Manufacturing process, Properties and uses

**8 HOURS**

**FIBRE REINFORCED CONCRETE****8 HOURS**

Matrix materials, Fibers: metal and synthetic, Properties and applications, Fibre reinforced plastics, Matrix materials, Fibers: organic and synthetic, Properties and applications

**FERROCEMENT AND FERROCONCRETE** Properties, Ferrocement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications

**ALTERNATIVE ROOFING SYSTEMS****6 HOURS**

Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

**COST EFFECTIVE BUILDING DESIGN**

Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives

**Text Books:**

1. "Alternative Building Materials and Technologies", KS Jagadish, BV Venkatarama Reddy and KS Nanjunda Rao, New Age International publications 2014

**REFERENCE BOOKS:**

1. "Building materials in Developing Countries", RJS Spence and DJ Cook, Wiley pub. 1983
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.

**V SEM CIVIL ENGINEERING  
DEPARTMENT ELECTIVE  
AIR POLLUTION**

Course Name	Air pollution	Course Code	16CV5DEAPL	SEE Duration	SEE+CIE
Credits	03	L-T-P-S Credits	3:0:0:0	03 Hours	50+50

**COURSE OBJECTIVE:**

This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

**COURSE OUTCOME**

- CO1:** Classify and analyze different types of air pollutants , explain their dispersion and effects on environment
- CO2:** Analyze particulates control by different methods
- CO3:** Explain air quality management, relevant standards and regulations
- CO4:** Discuss causes, effects and control of noise pollution

**SOURCES AND EFFECTS OF AIR POLLUTANTS**

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles, numerical problems

**8 HOURS**

**DISPERSION OF POLLUTANTS**

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

**8 HOURS**

**AIR POLLUTION CONTROL**

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries, Numerical problems.

**8 HOURS**

**AIR QUALITY MANAGEMENT**

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

**8 HOURS**

**NOISE POLLUTION**

Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention

**5 hours**

**CASE STUDIES:** on air pollution control and noise pollution control

**2 hours****Text Books**

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2015
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 2015
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 2015

**REFERENCES**

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 2015
2. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 2015
- 3 Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi,2015.
4. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi

**V SEM CIVIL ENGINEERING  
DEPARTMENT ELECTIVE  
DISASTER MANAGEMENT AND MITIGATION**

<b>Course Name</b>	<b>Disaster management and mitigation</b>	<b>Course Code</b>	<b>16CV5DEDMM</b>	<b>SEE Duration</b>	<b>SEE+CIE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S Credits</b>	<b>3:0:0:0</b>	<b>03 Hours</b>	<b>50+50</b>

**Course Objective:**

The objective of the course is to make the students learn basics of disaster management and mitigation.

**Course OUTCOMES:**

Ability to :

**CO1:** Differentiate types of disasters, its causes and identify vulnerable areas in India

**CO2:** Suggest mitigation techniques during disaster

**CO3:** Explain disaster management planning methods and execution of emergency management programme

**Introduction:** Definiton, terms, classification of disaster-natural and man made; global, regional, causes- social conditions, geo-climatic conditions **3 hours**

**Hazard mapping:** Levels of disaster as per National guide lines, approaches to study natural and man made disaster, hazard mapping of vulnerable areas in India, Response time, frequency, forewarning, exposure time of different hazards. **9 hours**

**Mitigation:** Risk assessment methods, Prevention, mitigation, preparedness, Tools and strategies, role of Information Technology, community based risk reduction mechanism **9 hours**

**Planning:** National disaster preparedness plan, planning methods, different phases of disaster management cycle, Disaster management act (2005), Disaster management Policy(2009), Public awareness creation, legal aspects, compensation, Insurance. **9 hours**

**Crisis Management:** Administrative and Organization, roles and responsibilities, Emergency management at field level, Health, food, nutrition, water, sanitation, social services, public awareness creation, Rumors and panic management, Case studies on various disasters mitigation, and management. **10 hours**

## **TEXT BOOKS**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.  
ISBN- 10:9380386427 ISBN13:978-9380386423

2).Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN -10:1259007367, ISBN 13:978-1259007361]

## **REFERENCES**

1.Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

2.Government of India, National Disaster Management Policy,2009.

3) various e-learning -,[www.ndmindia.nic.in](http://www.ndmindia.nic.in)

4).Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management,NIDM, New Delhi, 2011

5).Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

6)Pradeep sahani, Alka Dhameja, Uma Medury, "Disaster mitigation experiences and reflection", PHI

**V SEM CIVIL ENGINEERING  
DEPARTMENT ELECTIVE  
GLOBAL WARMING AND CLIMATE CHANGE**

<b>Course Name</b>	<b>Global warming and climate change</b>	<b>Course Code</b>	<b>16CV5DEGWC</b>	<b>SEE Duration</b>	<b>SEE+CIE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S Credits</b>	<b>3:0:0:0</b>	<b>03 Hours</b>	<b>50+50</b>

**OBJECTIVES**

1. To know the basics, and importance of global warming
2. To know the concept of mitigation measures against global warming

**OUTCOME**

- CO1: Describe causes and effects of green house gases
- CO2: Explain causes and impact of climate change and global measures taken
- CO3: Suggest mitigation techniques for climate change

**EARTH'S CLIMATE SYSTEM**

Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radiative Effects of Greenhouse Gases-The Hydrological Cycle-Green House Gases and Global Warming – Carbon Cycle. **(8 hours)**

**ATMOSPHERE AND ITS COMPONENTS**

Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere-Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion. **(8 hours)**

**IMPACTS OF CLIMATE CHANGE**

Causes of Climate change : Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes. **(8hours)**

**OBSERVED CHANGES AND ITS CAUSES**

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India . **(8 hours)**

**CLIMATE CHANGE AND MITIGATION MEASURES**

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate

Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

**(8hours)**

### **TEXT BOOK**

1. Dash Sushil Kumar, “*Climate Change – An Indian Perspective*”, Cambridge University Press India Pvt. Ltd, 2007.

### **REFERENCES**

1. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.

2. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.

3. Jan C. van Dam, Impacts of “*Climate Change and Climate Variability on Hydrological Regimes*”, Cambridge University Press, 2003.