ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

BMS COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous College under VTU)

DEPARTMENT OF CIVIL ENGINEERING

SCHEME & SYLLABUS
FOR B.E AUTONOMOUS

VII AND VIII SEMESTER, B.E. CIVIL ENGINEERING
(ADMISSION YEAR: 2014-15 onwards)

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು–560 019

BMS COLLEGE OF ENGINEERING

Bull Temple Road, Bengaluru - 560 019

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19
(Autonomous College under VTU)
DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION OF THE DEPARTMENT

Vision

To be an excellent center for imparting quality higher education in Civil Engineering for a constantly changing societal needs with credibility, integrity and ethical standards.

Mission

Accomplish excellence in curricular, co-curricular activities with a committed faculty through teaching and research which creates technically competent and dedicated civil engineers to serve their surroundings with pride.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. Practice Civil Engineering in construction industry public sector undertaking and as an entrepreneur for successful professional career.
2. Pursue higher education for professional development.
3. Exhibit leadership qualities with demonstrable attributes in lifelong learning to contribute to the societal needs.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

The Graduates after completion of the programme will be able to:

PSO1	Analyze and design Building and Transportation systems
PSO2	Become environmentally and socially responsible citizens with awareness of the use of sustainable material and technologies and provide alternate engineered solutions
PSO3	To design water supply and sewerage systems

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Engineering Graduates will be able to:

PO1:	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	**Conduct investigations of complex problems :** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6:	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering
PO7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8:	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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DEPARTMENT OF CIVIL ENGINEERING

(Admission year 2014 onwards) VII SEMESTER B.E

Course Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours	MARKS			SEE DURATION Hours
			L	T	P	S			CIE	SEE	TOTAL	
16CV7IE—	IEC-1	-------	3	-	-	-	3	3	50	50	100	3
16CV7DCDDG	Design & Drawing of RCC & Steel Structures	CIVIL	3	0	1	-	4	5	50	50	100	4
16CV7DCPSC	Analysis and Design of Pre-stressed concrete members	CIVIL	4	0	-		4	4	50	50	100	3
16CV7DCQSC	Quantity Surveying & Costing	CIVIL	3	1	-	2	6	5	50	50	100	4
16CV7DCTRS	Transportation Systems	CIVIL	3	0	-	-	3	3	50	50	100	3
16CV7DE----	DEC-4	CIVIL	3	-	-	-	3	3	50	50	100	3
16CV7DCMAP	Major Project (Phase-1)	CIVIL			-	-	2	-	50	50	100	
			Total Credits				**25**	**23**			**700**	

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VII SEMESTER INSTITUTIONAL ELECTIVE-IEC-1

Subject Code	Course Title	Teaching Department	Credits			Total Credit	Contact Hours
			L	T	P		
16CV7IERSG	Remote Sensing & GIS	CIVIL	3	-	-	3	3
16CV7IEFEA	Finite Element Method of Analysis	CIVIL	3	-	-	3	3

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DEPARTMENT OF CIVIL

(Admission year 2014 onwards)VII SEMESTER-DEPARTMENT ELECTIVES

Course Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours	MARKS		
			L	T	P	S			CIE	SEE	TOTAL
16CV7DEADR	Advanced Design of RC Structures	CIVIL	3	-	-	-	3	3	50	50	100
16CV7DEAFD	Advanced Foundation Design	CIVIL	3	-	-	-	3	3	50	50	100
16CV7DEGDR	Geometric Design of Roads	CIVIL	3	-	-	-	3	3	50	50	100
16CV7DEGHY	Ground Water Hydrology	CIVIL	3	-	-	-	3	3	50	50	100
16CV7DEIWW	Industrial Waste Water Treatment	CIVIL	3	-	-	-	3	3	50	50	100
16CV7DEDDB	Design and drawing of Bridges and Irrigation Structures	CIVIL	2	-	1	-	3	4	50	50	100
16 CV7DESDY	Structural Dynamics	CIVIL	2	-	1	-	3	3	50	50	100

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DEPARTMENT OF CIVIL

(Admission year 2014 onwards) VIII SEMESTER B.E

Subject Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours	MARKS			SEE DURATION HRS
			L	T	P	S			CIE	SEE	TOTAL	
16CV8IE-----	IEC-2	-	3	-	-		3	3	50	50	100	3
16CV8 HS CMF	Construction Project management, finance and professional ethics (HSS CORE)	CIVIL	2	-	-	1	3	2	50	50	100	3
16CV8DE-----	Dept. Elective - 5 (DEC-5)	CIVIL	3	-	-		3	3	50	50	100	3
16HS 8 DE —	HSS ELECTIVE	-	2	-	-	1	3	2	50	50	100	3
16CV8DCMAP	Major Project (Phase-2)	CIVIL		-	-		11	-	100	100	200	-
*16CV8DCITP	Internship/Industrial Training	CIVIL	-	-	-		2	-	50	50	100	-
			Total Credits				**25**	**10**			**700**	

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VIII SEMESTER-INSTITUTIONAL ELECTIVE

Subject Code	Course Title	Teaching Department	Credits			Total Credits	Contact Hours
			L	T	P		
16CV8IEOSH	Occupational Safety and Health Administration	CIVIL	3	-	-	3	3

NOTE:

16CV8DMITP – Mandatory Course of Industrial training internship (to be completed either during the vacation of 6th & 7th semester or 7th & 8th Semester for a minimum period of 4 weeks. Students shall apply reasoning based on the solutions provided in the civil Engg construction projects and assess issues related to societal, health, safety, legal and cultural issues as applied to civil engineering practice.

16CV8DEINS: Independent study for one or two credits can be offered additionally to those students who fall short of Seminar or mini project or self-study in the core courses or electives of final year can be taken up.

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(Admission year 2014 onwards)VIII SEMESTER B.E-DEPARTMENT ELECTIVE

Subject Code	Course Title	Teaching Department	Credits			Total Credits	Contact Hours
			L	T	P		
16CV8DEERD	Earthquake Resistant Design of Structures	CIVIL	3	-	-	3	3
16CV8DEEIA	Environmental Impact Assessment	CIVIL	3	-	-	3	3
16CV8DEGEE	Geotechnical Earthquake Engineering	CIVIL	3	-	-	3	3
16CV8DEIWM	Integrated Watershed Management	CIVIL	3	-	-	3	3
16CV8DERES	Reinforced Earth Structures	CIVIL	3	-	-	3	3
16CV8DEUTP	Urban Transport Planning	CIVIL	3	-	-	3	3

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(Admission year 2014 onwards)VIII Sem B.EHSS ELECTIVE

Subject Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours	MARKS		
			L	T	P	S			CIE	SEE	TOTAL
16HS8DE LFE	Law for Engineers	Humanities	2	-	-	1	3	2	50	50	100
16HS8DE BMS	Basics of marketing and sales	MBA	2	-	-	1	3	2	50	50	100
16HS8DE EFE	Economics for Engineers	MBA	2	-	-	1	3	2	50	50	100
16HS8DEMAE	Management and Entrepreneurship	MBA	2	-	-	1	3	2	50	50	100

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VII SEMESTER

INSTITUTIONAL ELECTIVE

Course Name	REMOTE SENSING AND GIS	Course Code	16CV7IERSG	SEE Duration	SEE+CIE
Credits	0 3	L-T-P-S	3-0-0	3 Hours	50+50

COURSE OBJECTIVES

To introduce remote sensing and GIS as a Vital tool for faster decision making. The main aim of the course is to impart knowledge on the concepts and application of remote sensing and GIS for general and specific tasks.

COURSE OUTCOMES

An Ability to

CO1: Explain the principles of Geodatabase

CO2: Discuss the application of multicriteria decision analysis for various issues.

CO3: Recognize the various advances in GIS

CO4: Outline the applications of enterprise and expert GIS

UNIT I

Geodatabase: Types of geodatabase, Advantages of geodatabase, Basic geodatabase structure, Topology, Relational classes, geometric networks, raster data - Creating geodatabase, organizing data, defining database Structure - Understanding spatial reference in geodatabase - Modifying spatial domain, Simple feature creation in geodatabase, Creating and editing map topology, Types of geodatabase annotation - Adding behavior to a Geodatabase **6 hrs**

UNIT II

Multi-Criteria Decision Analysis and SDSS: Elements of multi-criteria decision analysis, classification of decision problems, evaluation criteria, hierarchical decision alternatives

and constraints, alternatives and decision variables, deterministic variables, criteria weighting , estimation weights, ranking methods, decision rules, multi-attribute decision rules, sensitivity analysis, multi-criteria spatial decision support systems (SDSS).
SDSS for location planning, application-specific capabilities; requirements of a SDSS.

8 hrs

UNIT III

Advanced GIS

Introduction to Geographic Resources Analysis Support System (GRASS) GIS Raster data handling Reclassification, recode map algebra Resampling and interpolation of raster data. Overlaying Spatial analysis Neighborhood analysis and cross-category statistics -buffering Cost surfaces --Terrain and watershed analysis –Modeling raster data-Vector data handling-Topological operations -Buffering –Overlay –Dissolve –clip,union intersect –Network analysis–Spatial interpolation–handling lidar point cloud data. **8 hrs**

UNIT IV

Expert GIS: Introduction to concepts of Expert GIS, Data formats, Proprietary file formats, translator and Transfer formats, open formats, standards, metadata, standards gazetteer, XML and GML, Spatial databases, Relational databases, object databases, GIS and databases, advanced database technology, derived mapping –
Generalization, text placement, automated cartography, data from imagery, Web GIS, simple maps in webpages, internet mapping sites, internet softwares, Mobile GIS –positioning, location based services, personal and Vehicle navigation, LBS for mass market, telematics. –Applications **6 hrs**

UNIT V

Enterprise GIS:User need assessment; old and new spatial database models, SDE layers, Geo database,Architecture design, capacity planning (Hardware), security planning, RDBMS software selection, GIS software selection, planning for migration. Enterprise GIS management. **6hrs**

UNIT VI

Case Studies: GIS analysis in transportation, GIS analysis in water management, urban development, environmental analysis, hydrological modeling, Habitat suitability modeling, virtual cities 3D modeling and visual simulation, Automata based models of Urban system, Other applications. **6hrs**

TEXT BOOKS

1. GIS and Multi-criteria decision analysis by Jacek Malczewski, John Wiley and sons.2015
2. Concepts and Techniques of Geographic Information Systems CP Lo Albert K W Yeung, 2015 Prentice Hall of India.
3. Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc, New York, 2014.

REFERENCE BOOKS

1. Remote sensing and Image interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 2014
2. Geographical Information Systems – Principles and Applications, Volume I edited by David J. Maguire, Micheal F Good child and David W Rhind, John Wiley Sons. Inc., New York 2014
3. Geographical Information Systems – Principles and Applications, Volume II edited by David J. Maguire, Micheal F Good child and David W Rhind, John Wiley Sons. Inc., New York 2014.

.nptel.ac.in/courses/105102015/50
. www.gistutor.com › ESRI ArcGIS

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DEPARTMENT OF CIVIL

Course Name	FINITE ELEMENT METHOD OF ANALYSIS	Course Code	16CV7IEFEA	SEE Duration
Credits	03	L-T-P	3-0-0	03 Hrs
Total Hrs	39 Hrs	SEE+CIE	50+50	

Course Objectives:

The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues associated with solids and structures.

Course Outcomes: At the end of the course, the student will be able to:

CO1 APPLY basics of Theory of Elasticity to continuum problems.

CO2 FORMULATE finite element like bar, truss and beam elements for linear static structural analysis.

CO3 DEVELOP finite element models for 2D elements.

CO4 COMPUTE Mass matrices for bar and beam elements.

CO5 SOLVE problems of limited complexity in Linear static and Dynamics of structures.

CO6 UTILIZE finite element software to simulate practical problems.

UNIT -1

Fundamental concepts: Principles of Elasticity: Concept of stress – Stress at a point – equilibrium equations. Strain displacement relationships in matrix form – Constitutive relationships for plane stress and plane strain. **03 Hrs**

Introduction to Finite element method (FEM), Basic concept, Historical background, Engineering applications, Classification of elements, Banded matrix and node numbering, Steps for solving problems using FEM. Commercial packages – Preprocessor, Solver and Post processor. **02 Hrs**

Approximate method of structural analysis – Rayleigh-Ritz method, Galerkin's method, Finite element method, etc. Rayleigh-Ritz method applied to simple axially loaded members and beam. **04Hrs**

UNIT - 2

One dimensional problems: Finite Element Modeling using two nodedbar element– Definition of generalized coordinates and identification of degrees of freedom. Polynomial based interpolation model, Convergence criteria, Shape functions, Stiffness matrix by minimum potential energy principle, Properties of stiffness matrix, Global stiffness matrix, Consistent load vectors for traction and body force and Temperature effects. Numerical problems on simple bars subjected to forces and temperature change for displacements, reactions and stresses. **06 Hrs**

UNIT - 3

Analysis of Trusses and beams: Formulation of stiffness matrix for trusses. Hermite shape functions, Formulation of stiffness matrices for beams, Consistent load vectors for uniformly distributed load and triangular load. Numerical examples on beams and Trusses. **06 Hrs**

UNIT - 4

Two dimensional problems: Nodal displacement parameters, PASCAL's triangle – geometric isotropy. Shape functions in Cartesian and Natural coordinates for three noded triangular (CST) and four noded quadrilateral elements. Concept of isoparametric elements, Development of strain-displacement matrix and stiffness matrix, Jacobian matrix, consistent nodal load vector. **07 Hrs**

Sub-parametric and Super-parametric elements and Numerical integration using gauss quadrature approach. Higher order elements – Serendipity and Lagrangian family of Finite elements. **04 Hrs**

UNIT - 5

Structural dynamics: Steps in FEM applied to problems in Structural dynamics – Consistent and lumped mass matrices – evaluation of Eigen values and Eigen vectors for simple bars and beams. **07 Hrs**

TEXT BOOKS

1. Krishnamoorthy C.S., "Finite Element Analysis", 2nd ed., Tata-McGraw-Hill Education Pvt. Ltd., 2004.
2. Desai.Y.M.,Eldho.T.I., and Shah. A.H., "Finite Element Method with Applications in Engineering", Pearson publication, 2011.

REFERENCE BOOKS

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", 2nd ed., Prentice Hall, India, 2003.
2. Zienkiewicz O.C., "The Finite Element Method – Basic & Fundamentals", 7th ed., Book-Aid International, 2013.
3. Reddy J.N., "An Introduction to the Finite Element Method", 3rd ed., Mc Graw-Hill, 2005.
4. Cook R.D., "Concepts and Applications of Finite Element Analysis", 4th ed., John Wiley & Sons, 2004.
5. Rajashekaran S., "Finite Element Analysis in Engineering Design", Wheeler Publishing, 2006.
6. Logan D.L., "First Course in the Finite Element Method", 4th ed., Cengage Learning, 2007.
7. Hughes T.J.R., The Finite Element Method: Linear Static and Dynamic Finite Element Analysis", 1st ed., Dover Publications, 2000

E-Books / Web References

http://nptel.ac.in/courses/112104115/

MOOCs

1. Finite Element Method (FEM) Analysis and Applications https://www.edx.org/ course/finite-element-method-fem-analysis-tsinghuax-70120073x
2. A Hands-on Introduction to Engineering Simulations https://www.edx.org/course/hands-introduction-engineering-cornellx-engr2000x

Alternate assessment tool (AAT) for CIE: Utilization of finite element software to simulate practical problems – ABAQUS/ANSYS.

Scheme of Examination: Answer any Five full questions out of seven questions. Note: At least one question from each units.

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DEPARTMENT OF CIVIL

Course Name	DESIGN AND DRAWING OF RCC AND STEEL STRUCTURES	Course Code	16CV7DCDDG	SEE Duration	SEE+CIE
Credits	04	L-T-P-S	3-0-1-0	4 Hours	50+50

Course Objective:

To provide knowledge of design and detailing of RCC and Steel Structural components

Course Outcomes:

An ability to:

CO1: Design and prepare working drawings of RCC Structural components

CO2: Design and prepare working drawings of Steel Structural components

PART A: RCC Structures

Given data -Drafting only

1. Beam slab floor system consisting of one way and two-way slabs and continuous beam (1- Sheet) **6 Hrs**

Design and Drawing

2. Square, Rectangular and Circular water tanks (3 – Sheets) **8 Hrs**
   (2- Isolated Column & footing with eccentricity & rectangular combined footing(2 Sheets) **8 Hrs**
3. Cantilever and counterfort retaining walls (2 – Sheets) **8Hrs**

PART B: Steel Structures

Given data-Drafting only

1. Beam to Beam and Beam to column (framed and seated), Bolted and welded connections. (2- Sheets) **6Hrs**

Design and Drawing

2. Column and column bases (slab base & gusseted base) (2- Sheets) **8 Hrs**
3. Simple and Built up beams and weldedplate girder (1- Sheet) **8 Hrs**

TEXT BOOKS

1. N. Krishnaraju, Structural Design & Drawing Reinforced Concrete & Steel, University Press.
2. S. Krishnamoorthy, Structural Design and Drawing (Concrete Structures), CBS publishers, New Delhi. Tata McGraw publishers.
3. N. Subramanian, Design of Steel Structures, Oxford University, Press.

REFERENCE BOOKS:

1. IS: 456-2000, IS: 800–2007, SP-16, SP-34, SP 6 (1) – 1984 or Steel Table.
2. B.C. Punmia, Reinforced Concrete Structures,Laxmi Publishing Co.
3. S.N.Sinha, Reinforced Concrete Design, McGraw-Hill Education
4. Negi, Design of Steel Structures, Tata McGraw Hill Publishers.

Question paper pattern:

To answer question no. 1 or 2 completely.

Question no. 1 Part A: 70 marks, Part B – 30 marks.

Question no. 2 – Part B: 70 marks, Part A – 30 marks.

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Course Name	ANALYSIS AND DESIGN OF PRESTRESSED CONCRETE MEMBERS	Course Code	16CV7DCPSC	SEE Duration	SEE+CIE
Credits	0	L-T-P-S	4-0-0-0	3 hours	50+50

Course Objectives

To understand the fundamental concept of pre-stressing and to analyze and design flexural members

Course outcome:

An ability to

1. Comprehend pre-stressing and its techniques.
2. Evaluate the nature of stresses in the flexural member.
3. Design the flexural member.

Introduction, Materials of pre stressing, Pre stressing systems

Basic concepts of pre stressing, historical development need for high strength of steel and concrete, terminology, advantages and applications. High strength concrete and high tensile steel Tensioning device, post tensioning systems, thermo electric pre stressing, chemical pre stressing. **7 hrs**

Analysis of PSC beams

Basic assumptions, analysis of pre-stress, resultant stresses at a section, pressure line or thrust line. Concept of load balancing, stresses in tendons, cracking moments **10 hrs**

Losses of pre stress, Deflection of pre-stressed concrete members

Nature of losses of pre stress, losses due to elastic deformation, loss due to shrinkage, creep, relaxation of stresses in steel, friction, anchorage slips, total losses allowed for design. Factors influencing the deflections, Importance of control of deflection. Short term and long term deflections. **08hr**

Flexure and shear strength of pre stressed concrete sections

Types of flexural failure, strain compatibility, code procedures, Full and partial pre-stressed sections. Principal stresses, design of section for Flexure, ultimate shear resistances, design of shear reinforcements. **10hrs**

Transfer of pre-stress in PSC members

Transmission of pre stressing force by bond, transmission length, bond stresses, end zone reinforcement, flexural bond stresses as per code practice. **5hrs**

Anchorage zone stresses, Design of pre tensioned and post tensioned flexural members

Introduction, stress distribution in end block, investigation of anchorage zone stresses, anchorage reinforcement. Dimensioning of flexural members, estimation of self-weight of the beam, design of post and pre tensioned beams, design of partially pre stressed members. **12hrs**

Scheme of Question paper: The examiner has to set a total of six questions choosing one from each unit, which includes a compulsory question covering the entire syllabus, and the student has to answer five full questions.

Text Books

1. Pre stressed concrete by N. Krishna Raju, 5th Edn Tata Mcgraw-Hill Publishing company limited
2. Pre stressed concrete by P.Dayaratnam,4th Edn, Oxford &IBH Publishers

References

1. Pre-stressed concrete, Analysis and Design Fundamentals by Antoine Ewaaman, McGraw Hill Publishers
2. Pre-stressed concrete by S.K. Mallik & A.P. Gupta, Oxford & IBH Publishing Co.
3. Pre-stressed concrete bridges by V.N.Vazirani and S.P Chandola 3rd ed. Khanna Publishers, New Delhi
4. Pre-stressed concrete by G.S.Pandit & Gupta CBS Publishers, New Delhi

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DEPARTMENT OF CIVIL

Course Name	QUANTITY SURVEYING AND COSTING	Course Code	16CV7DCQSC	SEE Duration	SEE+CIE
Credits	06	L-T-P-S	3-1-0-2	4 hours	50+50

COURSE OBJECTIVES:

To provide basic knowledge of estimation and analyse the methods of estimation for various civil engineering works

COURSE OUTCOMES:

CO1: Estimate the material quantities of various Civil Engineering works

CO2: Apply Cost Estimate

CO3: Perform Rate analysis

CO4: Write specifications for various items

INTRODUCTION:

Estimation, types of estimation, approximate methods of estimation, Detailed methods of estimation, cost of materials and labour. **4Hrs**

ESTIMATION OF BUILDINGS:

Introduction, terms used in estimation, units of measurement, abstract. Methods of taking out quantities– center line method, long wall and short wall method. Preparation of detailed and abstract of estimates for the following Civil Engineering works – Masonry buildingswith flat roofs. RCC structural elements such as slabs, column, isolated footings and beams. **15 Hrs**

ESTIMATION OF OTHER CIVIL WORKS:

Steel trusses, RCC slab culvert, manhole and septic tanks.

8 Hrs

EARTHWORK ESTIMATION:

Methods of earthwork estimation. Estimation of earthwork of roads by mid sectional area method, mean sectional area method, trapezoidal and prismoidal formula methods.

8 Hrs

SPECIFICATIONS:

Introduction, Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of common item of works in buildings only. **8 Hrs**

ANALYSIS OF RATES: Definition. Working out quantities and rates for the following standard items of works – Earth work in different types of soils, plain cement concrete of different mixes, brick and stone masonry, flooring, plastering, RCC works.

12 Hrs

TEXT BOOK

1. Estimating and Costing in Civil Engineeringby B. N. Dutta, UBS Publishers and distributors Pvt. Ltd, New Delhi

REFERENCE BOOKS:

1. Quantity Surveying-P.L.Basin S. Chand: New Delhi.
2. Estimating & Specification - S.C. Rangwala::Charotar publishing house, Anand.
3. Text book of Estimating & Costing- G.S. Birde, Dhanpath Rai and sons : New Delhi.
4. A text book on Estimating, Costing and Accounts- D.D. Kohli and R.C. Kohli S. Chand : New Delhi.

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Course Name	TRANSPORTATION SYSTEMS	Course Code	16CV7DCTRS	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 hours	50+50

COURSE OBJECTIVES:

To provide the basic knowledge of Transportation systems, Components of permanent way, types of rails and its components, Design of Rail Geometrics, to understand the Layout of an airport and its classification, Design of Runway and Taxiways and Introduction to harbor and tunnel engineering, to provide the basics of traffic engineering and introduction to intelligent transportation systems.

COURSE OUTCOMES:

CO1: Identify the components of permanent way and their required quantity of materials for construction.

CO2: Design the geometrics of a Railway Track.

CO3: Calculate the corrected runway length and taxiway geometrics.

CO4: Recognise the fundamentals of Harbour and Tunnel Engineering.

CO5: Explain the concepts of Traffic Engineering.

Introduction: Role of railways in transportation, Indian Railways, selection of routes.

02 Hours

Permanent way: Introduction, requirements for an ideal permanent way, typical cross sections of single and double line B.G. tracks – in cutting , embankment. Gauges and types of gauges with dimensions. Coning of wheels and tilting of rails. Problems on these. Rails functions requirements, types of rail sections. **04 Hours**

Ballast and Sleepers: Functions, requirements, types, track fittings and fasteners, calculation of quantity of materials needed for laying a track.

Traction and tractive resistances, tractive power, Hauling capacity. Problems on above. **05 Hours**

Geometric Design of Track – Necessity of Geometric Design of railway track, gradient and types of gradient. Speed of train, curve, transition curve, super elevation, cant-deficiency, negative cant- speed calculation based on Indian Railways Formulae for High speed tracks only-problems on above. **08 Hours**

AIRPORT, TUNNELS & HARBOUR ENGINERING

Introduction: Introduction to airport engineering, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications - Site selection- Regional Planning. **03 Hours**

Runway Design- Orientation of runway by using wind rose diagram, the runway configurations- basic length of the runway –corrections to runway length by ICAO and FAA specification- runway cross sections- problems on above. **06 Hours**

Taxiway Design: Factors affecting the layout of the taxiway-geometrics of taxiway-design of Exit taxiways- ICAO Specifications. Problems on above. **03 Hours**

Tunnels: Introduction – types of tunnels, advantages and disadvantages. **02 Hours**

Harbours: Introductions, classifications, natural phenomenon affecting the design of harbour viz. wind, wave, tide and currents. Harbor layout with component parts

02 Hours

Introduction to Traffic Engineering: Definition, objectives and scope of Traffic

Engineering, factors affecting road traffic; Concepts of passenger car units for mixed traffic flow. **04 Hours**

A Site visit is recommended

Text Books:

1. Saxena and Arora, "Railway Engineering", Dhanpat Rai and Sons, New Delhi.
2. Khanna, Arora and Jain – Airport Planning and Design – Nemchand Roorkee.
3. SrinivasanRHarbour, Dock & Tunnel Engineering, Charotar Publishing House.
4. Kadiyali, L.R. `Traffic Engineering and Transport Planning', Khanna Publishers
5. Khanna, S.K. Justo,C.E.G. and Veeragavan. A " Highway Material Testing", Nemchand and Bros, Roorkee, 2009

DEPARTMENT ELECTIVES
VII SEMESTER

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous College under VTU)

DEPARTMENT OF CIVIL

Course Name	**ADVANCED DESIGN OF RC STRUCTURES**	**Course Code**	**16CV7DEADR**	**SEE Duration**	**SEE+CIE**
Credits	**03+00**	**L-T-P-S**	**3-0-0-0**	**3 hours**	**50+50**

Course Objectives:

To provide the knowledge of Design of RCC Structures like water tanks, different types of footings and retaining walls.

Course Outcome:

An ability to:

CO1: Analyze and design the components of water tank and curved beams

CO2: Analyze and design the components of slabs and foundations.

Design of Water Tanks:

Design of RCCOHT (Rectangular, circular) **8 Hours**

Beams curved in plan:

Introduction–Design Principles–Structural Design of beams curved in plan of circular and rectangular types. Deep Beams: Introduction – flexural and shear stresses in deep beams. **8 Hours**

Flat slabs:

Introduction, Components- I.S. Code Provisions – Design methods, Design for flexure and shear. **6 Hours**

Grid Floor Slabs:

Design of grid floor slabs by approximate methods **6 Hours**

Design of Culverts and Flyovers

Box and slab culvert, flyovers. **8 Hours**

TEXT BOOKS

1. Varghese P.C, Advanced Reinforced Concrete, Prentice Hall of India.
2. B C Punmia, Reinforced Concrete Structures, Vol-II, Laxmi Publications (P) Ltd, New Delhi.

REFERENCE BOOKS

1. P C Varghese, Limit State Design of Reinforced Concrete Vol-II, Prentice Hall of India (P) Ltd, New Delhi.
2. Jain A.K, Limit State Design of Reinforced Concrete, Nemchand& Bros., Roorkee.
3. Vazirani V N & M MRatwani, Analysis of Structures- Vol-II,Khanna Publishers, New Delhi.
4. S. S. Bhavikatti, Advanced RCC Design-Vol-II, New Age International Publication, New Delhi.
5. IS Codes: IS: 456, IS:875, SP:16, SP:34.
6. H.J. Shah, Reinforced Concrete, Charoatr Publishers.

E-book

1. NPTEL-Course Material-nptel.ac.in.

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	ADVANCED FOUNDATION DESIGN	Course Code	16CV7DEAFD	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 hours	50+50

Course Objectives:

Understand the need for having foundation and their types to suit the practical requirements. Develop an understanding about the requirements of foundations for their satisfactory performance.

Course Outcomes: An ability to

CO1: Classify and suggest foundation type for various field and loading conditions, understand the basic requirements of a satisfactory foundation and the determinants of foundation location and depth, and proportion shallow foundations.

CO2: Estimate individual vertical and lateral pile load capacity, pile group capacity, and pile group efficiency.

CO3: Explain the causes of expansive nature of clays, simple methods to assess the swelling potential and methods to prevent and overcome swelling of expansive clays

SHALLOW FOUNDATIONS

Introduction, Types of shallow foundations. Basic requirements of satisfactory foundation - Location and depth criterion, stability criterion, settlement criterion.

Determination of foundation location and depth. Bearing capacity theories-Terzaghi, Meyerh of, Skempton, Vesic and Brinch Hansen. Settlement of shallow foundation, types-immediate, consolidation and differential settlements. Principles of design of footing, proportioning of isolated, combined rectangular and trapezoidal footings (proportioning only) **12hours**

PILE FOUNDATIONS

Introduction, Necessity of pile foundation, classification. Load carrying capacity by dynamic formula- Engineering News formulae and Hiley's formulae, static method, Correlations with SPT and CPT, Pile load test. Negative skin friction, pile groups, group action of piles in sand and clay, group efficiency, Concepts of Wave Equation Analysis (WAP) and Case Method Analysis by Wave Equation Analysis (CAPWAP) of Piles. Pile Driving Analyser(PDA) and Pile Integrity Test (PIT) **12 hours**

LATERALLY LOADED PILE FOUNDATIONS

Pile and pile groups subjected lateral loads. Batter piles, response to shear and moment loads, boundary conditions. Methods of design of laterally loaded vertical piles. Lateral load capacity by Reese and Matlock method (Elastic method) and Broms method (plastic method) **12 hours**

FOUNDATIONS ON EXPANSIVE SOIL

Introduction, Identification, Mineral structure, free swell test, Index properties of expansive soils, Definition of swell pressure, swell potential, their determination, CNS layer, foundation treatment for structures in expansive soil **3hours**

TEXT BOOKS

1. Murthy V.N.S., (2007) "Advanced Foundation Engineering", 1st Edition, C.B.S Publishers, Bangalore
2. Varghese P.C., (2007) "Foundation Engineering"- Prentice hall of India, New Delhi

REFERENCE BOOKS:

1. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
2. Braja, M. Das (2010), "Principles of Foundation Engineering", Seventh Edition, World Press.
3. Donald Coduto P (1994) "Foundation Design-Principles and Practices", Prentice Hall.
4. Relevant B.I.S codes.

E-BOOKS

1. http://nptel.ac.in/courses/105107120/

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous College under VTU)

DEPARTMENT OF CIVIL

Course Name	GEOMETRIC DESIGN OF ROADS	Course Code	16CV7DEGDR	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

To understand the design aspects of road geometrics to address the practical problems in highway engineering.

COURSE OUTCOME:

An ability to

CO1: select appropriate cross sectional elements of a roads

CO2: Analyse the horizontal alignment of a roads

CO3: Analyse the vertical alignment of a roads

CO4: Design various types of intersections of a roads

INTRODUCTION:

Importance of Geometric Design, Geometric Controlsand Criteria as per IRC and AASHTO standards and specifications, PCU Concepts, factors controlling PCU for different design purpose **02 Hours**

CROSS SECTIONAL ELEMENTS:

Pavement surface characteristics – friction – skid resistance–Problems – pavement unevenness - light reflecting characteristics, Camber – objectives – types of camber – methods of providing cambers in the field – problems, Carriage way, Kerbs, Medians, Road margins, Roadway, Right of way, Design of Road humps as per latest IRC provisions. **08 Hours**

SIGHT DISTANCE:

Importance-Types, Stopping Sight Distance, Overtaking Sight Distance, Criteria for Sight Distance requirements, Sight distance at uncontrolled intersection, derivation, factors affecting sight distance, IRC standards and problems on above. **06 Hours**

HORIZONTAL ALIGNMENT:
Definition, Design Speed, Horizontal Curves, Super elevation, Radius of Horizontal Curve, Assumptions – problems – method of providing super elevation for different curves, Widening of Pavement on Horizontal Curves – objectives – Mechanical widening – psychological widening, Horizontal Transition Curve – objectives – Ideal requirements – Types of transition curve – Method of evaluating length of transition curve, Set-back distance on horizontal curve, Curve Resistance and problems on above **08 Hours**

VERTICAL ALIGNMENT:
Gradient – Types of gradient – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD – Night visibility considerations – Design standards for hilly roads – problems on the above. **08 Hours**

INTERSECTION DESIGN:
Principle – At-grade and Grade separated junctions – Types – Un-channelized Intersections, Channelized Intersections, Rotary Intersection – Problems, Signalized Intersections. **06 Hours**

Text Books:

1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.
2. R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press (India) Private Ltd., 2012.

REFERENCE BOOKS:

1. L. R. Kadiyali& N. B. Lal, "Princple and Practice of Highway Engineering", Khanna Publications, 2005.
2. Relevant IRC Publications –such as IRC99, IRC-35, IRC-82, etc

E-BOOKS

1. nptel.ac.in/downloads/105101087/
2. http://freevideolectures.com/Course/91/Introduction-to-Transportation-Engineering/23

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19
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DEPARTMENT OF CIVIL

Course Name	GROUNDWATER HYDROLOGY	Course Code	16CV7DEGHY	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

The objective of this course is to understand the ground water availability, flow and storage with relevant techniques of practical relevance.

COURSE OUTCOME: An ability to

CO1: Explain the fundamental concepts of the occurrence and movement of groundwater

CO2: Estimate the ground water flow rate and flow direction using modeling techniques

CO3: Estimate the yield from a well and analyse the performance of a recharge well

CO4: Analyse the movement of pollutants in groundwater and explain the freshwater and groundwater interface

CO5: Explain various surface and subsurface groundwater investigation methods

INTRODUCTION:

Groundwater utilization &historical background, groundwater in hydrologic cycle, groundwater budget, and groundwater level fluctuations **3 Hrs**

OCCURRENCE AND MOVEMENT OF GROUNDWATER:

Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, groundwater basins & springs,

Darcy's Law, permeability & its determination, Dupuit assumptions, Groundwater flow rates & flow directions, general flow equations through porous media, Groundwater Interaction with Streams and Lakes **9Hrs**

WELL HYDRAULICS:

Steady/ unsteady, uniform/ radial flow to a well in a confined/ unconfined /leaky aquifer, partially penetrating/horizontal wells, testing for yield, Hydraulics of recharge wells. Concept & methods of artificial ground water recharge, wastewater recharge for reuse

10 Hrs

POLLUTION AND QUALITY ANALYSIS OF GROUNDWATER:

Sources of groundwater pollution, advection and dispersion, criteria & measures of ground water quality, ground water salinity, groundwater remediation **04 Hrs**

SALINE WATER INTRUSION IN AQUIFERS:

Ghyben-Herzberg relation between fresh & saline waters, shape & structure of the fresh & saline water interface, upcoming of saline water, saline water intrusion control **6 Hrs**

SURFACE/ SUB-SURFACE INVESTIGATION OF GROUND WATER:

Geological /geophysical exploration/ remote sensing / electric resistivity /seismic refraction based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation **7 Hrs**

TEXT BOOKS

1. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
2. K. R. Karanth, "Hydrogeology", TataMcGraw Hill Publishing Company.

REFERENCE BOOKS:

1. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000.
2. Bear J., Hydraulics of Groundwater, McGrow-Hill International, 1979.
3. Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice- Hall, 1987.
4. S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993.

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	INDUSTRIAL WASTE WATER TREATMENT	Course Code	16CV7DEIWW	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

The principal objective of Industrial wastewater treatment is generally to allow industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment. The main aim of this course is to impart knowledge on the concept and application of industrial pollution prevention, cleaner technologies, industrial wastewater treatment and disposal of effluents.

COURSE OUTCOME: An ability to

CO1: Describe the effects of industrial waste water on streams and treatment plants.

CO2: Explain the process of natural purification of streams and various pre-treatment methods.

CO3: Recognize sources, characteristics and treatment methods of industrial waste water.

INTRODUCTION:

Importance of treatment of industrial waste water, Difference between domestic and industrial wastewater, effects on streams and on Municipal Sewage treatment plants, and receiving water bodies. **6 Hours**

NATURAL PURIFICATION STREAMS:

Stream quality, dissolved oxygen Sag curve in Streams, Stream sampling, effluent and stream standards and legislation to Control water pollution. Streeter-Phelps formulation, Numerical problems on DO prediction. **06 Hours**

PRETREATMENT OF WASTE WATER:

A number of strategies will be examined for the pretreatment/treatment of Industrial waste water. The effects of various pretreatment methods are discussed independently and in combination. Pre-treatment method includes-Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning. **08 Hours**

TREATMENT METHODS:

Removal of Inorganic, Organic solids, suspended and colloidal solids, Treatment and disposal of sludge Solids. **06 Hours**

COMBINED TREATMENT METHODS:

Feasibility of combined treatment of industrial raw wastewater with Domestic Wastewater, Discharge of raw, partially treated and completely treated waste waters to streams.

06 Hours

Case studies

Characteristics and Composition of waste water and Manufacturing processes of Industries like Paper and pulp, Cotton textile industry; Tanning Industry, cane sugar industry & distillery industry; Dairy industry; Steel and cement Industry, Pharmaceutical Industry.

08 Hours

TEXT BOOKS:

1. M.N.RAO AND A.K.DATTA (2015) - Wastewater Treatment.
2. Nemerow N.L., (2006) – Industrial Wastewater Treatment- Contemporary New York.Practice and Vision for the Future, Elsevier Science and technology.

REFERENCE BOOKS:

1. Ross R.D. (1968), "Industrial Waste Disposal", Reinhold Environmental Series,
2. Mahajan (1984) –" Pollution control in Process industries". TMH, New Delhi.
3. G.L.KARIA AND R.A.CHRISTIAN (2008) - Wastewater Treatment-concepts and Design Approach PHI learning, New Delhi-110001.
4. Eckenfelder (2000), "Industrial Water pollution Control"- McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA.

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	DESIGN AND DRAWING OF BRIDGES & IRRIGATION	Course Code	16CV7DEDDE	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-1-0	3 Hours	50+50

Course Objectives:

To enable the students to design basic types of bridges and irrigation structures and to prepare their drawings.

Course Outcomes: An ability to:

CO1: Design and Draw different types of bridges.

CO2: Design and draw major hydraulic structures.

PART-A : Bridges

Introduction - Standard Specifications for Road Bridges – Indian Road Congress Standards – Carriage way Width & clearances – Design Loads – IRC Standard live loads – Basic Design Principles of Bridge Sub-Structures Design of Reinforced cement concrete slab culvert , Design of deck slab using Piguard's curves.

Bridge drawing using the data given for

a) RCC T – Beam and slab bridge

b) Steel Plate Girder Bridge for railways.

c) Slab culvert

PART-B IRRIGATION STRUCTURES

Design and Prepare detailed drawings of major hydraulic structures associated with irrigation. Drawing will be done to details furnished

a). Surplus weir

b). Canal Regulator

c). Canal drop

Text Book

1. N.KrishnaRaju, "Design of Bridges" Oxford & IBH Publishing Ltd. 4th Edition - 2009.
2. Ponnuswamy "Bridges Engineering" Tata McGrawHill– 2nd Edition, 20071. Arora KR "Irrigation Water Power & Water Resources Engineering"- - Standard Publishers Distributors – 2010.
3. C Satyanarayana Murthy "Water Resources Engineering: Principles and Practice" - New Age International Publishers - 2000.
4. P.N. Modi, "Irrigation, Water Resources, and Water".
5. R.K. Sharma "Text Book of Irrigation Engineering and Hydraulic Structures" - Oxford and IBH Publishing Co., New Delhi.
6. B.C. Punmia and PandeLal, "Irrigation and Water Power Engineering" - Laxshmi Publications, New Delhi – 2009.

Question paper pattern:

Q1 is compulsory and answer any one full question from Q2 and Q3

Q1 – Theory questions for 30 marks from both bridge and irrigation.

Q2 – Part-A bridge drawing – 40 marks, Part B – Irrigation Drawing – 30 marks

Q3 – Part-A bridge drawing – 40 marks, Part B – Irrigation Drawing – 30 marks

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	STRUCTURAL DYNAMICS	Course Code	16CV7DESDY	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-1-0-0	3 Hours	50+50

Course Objective:

- Enable the students to understand time dependent response of linear systems
- To enable students to learn the physical behaviour of vibrating systems through experimental modules

Course outcomes: An ability to

1. Compute natural frequency and free vibration response of SDOF systems
2. Set-up the equation of motion and obtain the Dynamic magnification factor of SDOF systems subjected to harmonic inputs
3. Set-up equation of motion of free-vibration response of MDOF systems and continuous systems, solve them to obtain natural frequencies (Eigen values) and mode shapes (Eigen vectors)
4. Conduct free vibration tests to obtain natural frequency and damping

1. Introduction: Introduction to Dynamical problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement, energy principles

2. Dynamics of Single-degree-of-freedom systems: Mathematical models of un-damped and damped SDOF system, Free vibration response of damped and un-damped systems, response to harmonic loading, support motion, evaluation of damping, vibration isolation, transmissibility, response to periodic forces. Numerical methods applied to SDOF, Direct integration and Duhamel integral, principle of vibration-measuring instruments–seismometer and accelerometer

3. Dynamics of Multi-degree freedom systems and continuous systems: Mathematical models of un-damped and damped MDOF systems, Free vibration of un-damped MDOF systems - Natural frequencies and mode shapes – orthogonality conditions, free vibration of damped MDOF systems, modal analysis – free and forced vibration with and without damping.Introduction to dynamics of continuous systems - free flexural vibration response uniform beams with various boundary conditions

4. Introduction to experimental dynamics: Free vibration - tests on SDOF and MDOF systems to obtain natural frequencies and mode shapes, obtaining damping through logarithmic decrement

Text Books:

1. Mario Paz , Structural Dynamics – Theory and computation, 4th edition, , Kluwer publication
2. William T Thomson ,Theory of Vibrations with application, 5th edition, , Pearson publication

Reference Books:

Anil K. Chopra ,Dynamics of Structures - -Prentice Hall of India
R.W. Clough &J.Penzien ,Dynamics of Structures --McGraw Hill
John M Biggs ,Introduction to Structural Dynamics--McGraw Hill pub
Schaum's outline series – Machanical vibrations-S Graham Kelly-McGraw Hill, India
M Mukhyopadhyay, Structural Dynamics--CRC Press, India

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	**MAJOR PROJECT (Phase-1)**	**Course Code**	**16CV7DCMAP**	
Credits	**02**	**SEE+CIE**	**50+50**	

Course Outcomes:

CO1: Identify a current problem through literature/field./case studies and define the background objectives and methodology for solving the same.

CO2: Write report and present it effectively.

The phase 1 of the project shall comprise of

- Problem identification in close collaboration with industry
- Literature Survey
- Deriving work content and carry out of project requirement analysis
- Submission of interim report
- Presentation to an expert committee
- Evaluation guidelines to be developed

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VIII SEMESTER B.E

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	Course Code	16CV8IEOSH	SEE Duration
Credits	03	L-T-P	3-0-0	03 Hrs
Total Hrs	40	SEE+CIE	50+50	

COURSE OBJECTIVES:

To introduce occupational safety and health as a vital tool for enforcing safe working conditions. The main aim of the course is to impart knowledge on the concept and application of safety and health issues at work environment.

COURSE OUTCOME

An ability to

CO1 : Demonstrate the knowledge of principles of safety and Legislation

CO2: Explain accident Investigation and Reporting

CO3: Recognize the various hazards and Risk analysis

CO4: Illustrate the various Occupational health and Toxicology issues.

UNIT I

Principles of safety:

History of Safety movement. Evolution of modern safety concept.-
general concepts of management planning for safety for optimization of productivity. Productivity, quality and safety line and staff. Functions for safety -budgeting for safety. safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection. **8Hrs**

UNIT II

Laws and Legislation

Occupational safety and Health act, Guide lines, Occupational safety and Health administration, Right to know laws, EHS (environment, Health and safety) and its compliance. **4 Hrs**

UNIT III

Accident Investigation and Reporting

Causes of an accident, reportable and non-reportable accidents, reporting to statutory authorities principles of accident prevention accident investigation and analysis records for accidents, departmental accident reports, documentation of accidents unsafe act and condition, domino sequence–supervisory role–role of safety committee cost of accident. Recommended practices for compiling and measuring work injury experience –permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices. **8Hrs**

UNIT IV

Fire prevention and control

Sources of ignition –fire triangle–principles of fire extinguishing–active and passive fire protection systems–various classes of fires A, B, C, D, E–types of fire extinguishers–fire stoppers–hydrant pipes–hoses–monitors–fire watchers–lay out of stand pipes –fire station -fire alarms and sirens–maintenance of fire trucks–foam generators–escape from fire rescue operations–fire drills –notice -first aid for burns.

Sprinkler -hydrants-stand pipes–special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards–alarm and detection systems. Other suppression systems –CO2 system, foam system, dry chemical powder (DCP) system, halon system –need for halon replacement –smoke venting. Portable extinguishers –flammable liquids –tank farms –indices of inflammability-fire fighting systems. **8Hrs**

UNIT V

Hazard risk analysis

Introduction, hazard, hazard monitoring -risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, Risk estimation.

Hazard assessment, procedure, methodology; safety audit, checklist analysis, what if analysis, safety review, preliminary hazard analysis(PHA), human error analysis, hazard operability studies(HAZOP),safety warning systems-Fault Tree Analysis and Event Tree Analysis, Logic symbols, methodology, minimal cut set ranking -fire explosion and toxicity index(FETI), various indices-Hazard analysis(HAZAN)-Failure Mode and Effect Analysis(FMEA)-Basic concepts of Reliability **6 Hrs**

UNIT VI

Occupational health and Toxicology

Concept and spectrum of health functional units and activities of occupational health services, pre-employment and post employment medical examinations
-occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention –cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human system **6 Hrs**

TEXT BOOKS:

1. Occupational safety and Health for Technologists, Engineers and Managers: Geotsch.D.L.Prentice Hall publishing.
2. Essentials of safety management: Kaila and singh, Himalaya publishing house.
3. Fire safety in Buildings. V.K.Jain, NewAge Publishers

REFERENCES:

1. National safety council of India, GOI Publication.
2. Loss prevention society of India publication
3. Industrial Accident prevention. Heinrich H.W. Mcgraw hill publication
4. Industrial accident prevention.Colling.D.A.Prentice hall publishing.
5. nptel.ac.in/courses/107103004/35
6. nptel.ac.in/courses/112107143/40

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous College under VTU)

DEPARTMENT OF CIVIL

Course Name	CONSTRUCTION PROJECT MANAGEMENT , FINANCE AND PROFESSIONAL ETHICS	Course Code	16CV8HSCMF	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-0-1	3 Hours	50+50

COURSE OBJECTIVES:

To provide basic knowledge of project management and economics, concepts of contract and ethics in Civil Engineering profession..

COURSE OUTCOMES:

An ability to:

CO1: Demonstrate the knowledge of organization structure of a project and apply scheduling techniques for managing construction projects.

CO2: Apply the concept of time value of money to different real time situations.

CO3: Analyse different economic feasible alternatives using present worth/rate of return methods of investment.

CO4: Examine the economics of a project and appraise financial statements

CO5: Apply professional ethics in engineering practice through case studies.

Project Organization, Introduction, Bar Charts, Work Breakdown Structure, Time estimates, Applications of CPM and PERT- Scheduling, Monitoring and Upating. **6Hrs**

Engineering economics, Time value of money, discounted cash flow, NPV, ROR, Bases of comparison, Incremental analysis, and Benefit-Cost analysis – **6 Hrs**

Finance-Capital budgeting, Working capital management, Construction accounting, Income statement, Financial statements, Appraisal through financial statements-ratio's analysis, case studies– **6 Hrs**

Contracts – General conditions of contract, types of contracts, breach of contract, Arbitration **4Hrs**

Professional ethics- Importance, motivation, impact of violation of professional ethics on society, remedies case studies **4Hrs**

References:

1. Chitkara K K, "Construction Project Management, Planning, Scheduling and Controlling, McGraw Hill Education, 3rd Ed., 2014.
2. Srinath L.S, "PERT and CPM", East West Press Pvt Ltd New Delhi.
3. Van Horne J.C, "Fundamentals of Financial Management" Prentice Hall, 2009
4. Blank L and Anthony T, " Basics of Engineering Economy", McGraw Hill Education, Indian Edition, 2013.
5. K G Krishnamurthy, S V Ravindra, "Professional Practice", PHI, 2014
6. Wueste, Daniel E, 'Introduction, Professional Ethics and Social responsibility', Rowman and Littlefield Publishers, Inc. London, 1994

E-Resources: Mooc:

https://onlinecourses.nptel.ac.in/noc17_mg01/preview

http://nptel.ac.in/courses/109104068/30

DEPARTMENT ELECTIVES
VIII SEMESTER

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	Course Code	16CV8DEERD	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0	3 Hours	50+50

COURSE OBJECTIVES:

- The knowledge of structural dynamics shall be utilized to introduce the students to engineering seismology and (b) concepts for earthquake resistant design
- Design and detailing aspects to achieve ductility in structures shall be emphasized

PRE-REQUISITE:

Structural Dynamics

Course outcomes;

CO1: Describe the fundamentals of engineering seismology

CO2: Characterize the Earthquake ground motions and prepare the basis for estimation of seismic forces

CO3: Analyse , design and detail , buildings for seismic resistance through concepts of ductility as per BIS codes

CO4: Identify and comprehend failure patterns of buildings during earthquake

Introduction to engineering seismology, seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments.

Seismic response of buildings, structures and sites, study of response of buildings and structures during past earthquakes.

The Response Spectrum – elastic and elasto-plastic spectra, tripartite plot, use of response spectrum in earthquake resistant design.

Dynamics of multi-storeyed buildings – natural frequencies and mode shapes, Analysis of multi-storeyed buildings, obtaining seismic forces using IS-1893.

Structural Configuration for earthquake resistant design, frames, shear walls and dual systems, Effect of infill masonry walls on frames, problems of the soft first-storey, Capacity design procedures.

Ductility and energy absorption in buildings, Reinforced concrete for earthquake resistance, confinement of concrete for ductility, ductility of columns and beams – codal provisions

Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings.

TEXT BOOK AND CODES:

1. P Agarwal and M Shrikande, "Earthquake Resistant Design of Structures", Prentice Hall (India) Ltd, New Delhi, 2006.
2. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993

3. REFERENCE BOOKS:

1. D J Dowrick, "Earthquake Risk Reduction"- John Wiley and Sons, 2003
2. Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw Hill Pub.
3. G GPenelis and A J Kappos, "Earthquake Resistant Concrete Structures", Chapman and Hall, 1999
4. T Paulay and M J N Priestley, "Seismic Design of Reinforced Concrete and MasonryBuildings", John Wiley and Sons, 1992
5. S.K.Duggal, (2007), "Earthquake Resistant Design of Structures", OxfordUniversity Press, New Delhi 2007.
6. Steven L Kramer, "Geotechnical Earthquake Engineering", Pearson Education pub.
7. Anil K Chopra, "Dynamics of Structures – Theory and Application to Earthquake Engineering"- 2nd ed., Pearson Education pub.
8. Anderson,R.A., "Fundamentals of Vibrations"- McMillan
9. Clough and Penzien, "Dynamics of Structures"- McGraw Hill
10. Mukyopadhyaya, "Vibration and Structural Dynamics", Oxford &IBH
11. James Ambrose and DimitryVergun, "Design for Earthquakes"-avid Key, "Earthquake Design Practice for Buildings".

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL

Course Name	ENVIRONMENTAL IMPACT ASSESSMENT	Course Code	16CV8DEEIA	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

To introduce the methodology of environmental impact assessment (EIA) as a vital tool for sound environmental management and decision-making.This course will explore the need for environmental impact assessments, the different types of assessments, and the regulatory and technical requirements of preparing an assessment.

COURSE OUTCOME: An ability to

CO1: Explain the major principles and mechanisms of Environmental Impact Assessment.

CO2: Describe the different stages of Environmental Impact Assessment in India.

CO3: Illustrate the process of issues concerning societal, ethical and legislative needs.

INTRODUCTION:

Definition, Evaluation of EIA in India, Development activity and Ecological factors, Relationship between EIA, EIS, and FONSI. Purpose and Need for EIA studies, Base line information. **6 Hrs**

FUNDAMENTAL APPROACH TO EIA/ EIA PROCEDURES:

Step- by- step procedure for conducting EIA, Advantages and Limitations of EIA. Hierarchy in EIA. Statutory Requirements in EIA, MoEF Guidelines in Siting Developmental Projects. **6 Hrs**

Methodologies of EIA:

Contents of EIA. Methodologies and Evaluation Techniques of EIA, their selection for Specific Projects. Frame work of impact Assessment related to Indian conditions. **6 Hrs**

ENVIRONMENTAL ATTRIBUTES:

Assessment and prediction of impacts on Attributes -Air, Water, Noise, Land, Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for development projects, Rapid and comprehensive EIA. **6 Hours**

PUBLIC PARTICIPATION IN EIA:

Basic Definitions, Regulatory Requirements, Objectives, Advantages and Disadvantages, Selection of Public Participation Techniques. **6 Hours**

IMPACT QUANTIFICATIONS:

EIA for Water resource developmental projects, Highway projects: Nuclear Power plant projects, Hazardous Waste disposal Sites, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities. **9 Hours**

Text Books:

1. Environmental Impact Assessment –L.W.Canter (1996), McGraw Hill Inc.
2. Environmental impact Assessment methodologies - Anjaneylu.Y.

Reference Books:

1. Environmental Impact analysis - Jain R.K, Urban & Stacey—Van Nostrand Reinhold Co
2. Guidelines for EIA of Developmental Projects. Ministry of Environment and Forests, Government of India.

E-BOOKS:

1. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm
2. nptel.ac.in/courses/105101084/https://ay14-15.
3. moodle.wisc.edu/prod/course/view.php?id=499.

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DEPARTMENT OF CIVIL

Course Name	GEOTECHNICAL EARTHQUAKE ENGINEERING	Course Code	16CV8DEGEE	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

To provide basic knowledge about Dynamic soil properties, Causes and mitigation of Earthquakes , measurement of Earthquakes, and Design of earthquake resistant of foundations and retaining walls.

COURSE OUTCOME:

An ability to

CO1: Explain the basic concepts of earthquake, its causes, evaluation and mitigation.

CO2: Identify dynamic soil properties and Compute factor of safety against liquefaction

CO3: Design earthquake resistant shallow foundations and retaining walls

INTRODUCTION:

Historical background, earthquake records of India, Plate tectonics, causes, Seismic waves, faults types, hypocenter, epicenter, focal depth, seismograph, parameters of ground motion, measurement of ground motion-accelerometers, magnitude and intensity of earthquake and its relationship, seismic zones, risk evaluation and mitigation, earthquake resistant structures, awareness campaign **8Hrs**

Fundamentals of Vibrations:

Introduction, Fundamental definitions, System with single degree of freedom, Free and Forced vibration of a spring-mas system, Free and steady-state forced vibration with viscous Damping, Rotating –mass-type Excitation, Determination of Damping Ratio, Vibration-measuring Instruments, System with two degrees of freedom-vibration of a mass-spring system and problems. **8 Hrs**

Dynamic soil properties

Introduction, soil properties for dynamic loading, Lab-fieldmeasurement, factors affecting ground motion, peak horizontal ground acceleration. **4Hrs**

Liquefaction

Introduction, factors governing, liquefaction Analysis- cyclic stress ratio, remedial measures for liquefaction, numerical problem on factor of safety against liquefaction. **04 Hrs**

Design of earthquake resistant shallow foundation and deep foundation

Introduction, Bearing capacity analysis for liquefied soil, granular soil with earthquake induced pore water pressure, analysis for cohesive soil weak end by earthquake, and concepts of design criteria for deep foundation – piles **08 Hrs**

Retaining wall analysis for earthquakes:

Introduction,.pseudostatic method, method of analysis for liquefied soil, analysis for reinforced concrete retaining walls, sheet pile walls, and braced excavation **07Hrs**

TEXT BOOKS:

1. Basic geotechnical earthquake Engineering, -Kamalesh Kumar, New age international publishers, first edition, (2008)
2. Principles of Soil Dynamics -Braja M. Dass, and G.V. Ramana, CL Engineering publishers; second edition (2010)

REFERENCE BOOKS:

1. Soil dynamics and machine foundations- Swami saran, Galgotia Publications, New Delhi
2. Geotechnical Earthquake Engineering-Steven L Kramer, Pearson publication, first edition (1996)

E-Resources:

1. Nptel courses: http://nptel.ac.in/courses/105101134/

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF CIVIL ENGINEERING

Course Name	INTEGRATED WATERSHED MANAGEMENT	Course Code	16CV8DEIWM	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

Objective of this course is to understand fundamental concepts of watershed behavior, planning and management, various methods available to estimate runoff and quantify soil erosion. Also the course helps to understand the techniques for the assessment of management of flood and droughts, the concepts of conjunctive use of water resources for effective watershed management.

COURSE OUTCOME: An ability to

CO1: Explain the fundamental concepts of watershed behavior and watershed management and explain the application of modern techniques in watershed management

CO2: Apply different models to estimate runoff and soil erosion from a watershed

CO3: Identify the types and sources of water pollution

CO4: Apply various methods to assess / model flood and drought

INTRODUCTION:

Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making 3 Hrs

INTEGRATED WATERSHED MANAGEMENT:

Integrated water resources management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; conjunctive use of water resources, rainwater harvesting, water conservation and recycling, Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Watershed Management Practices in Arid and Semiarid Regions, Case studies. **7 Hrs**

WATERSHED MODELING:

Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-run off process, subsurface flows and groundwater flow Soil erosion, estimation of soil erosion **10 Hours**

MANAGEMENT OF WATER QUALITY:

Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality **06 Hours**

STORM WATER AND FLOOD MANAGEMENT:

Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage

Drought Management:

Drought assessment and classification, drought analysis techniques, drought mitigation planning. **9 Hours**

USE OF MODERN TECHNIQUES IN WATERSHED MANAGEMENT:

Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management **4 Hours**

TEXT BOOKS

1. Vir Singh, Raj, Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

REFERENCE BOOKS:

1. Allam, Gamal Ibrahim Y., Decision Support System for Integrated WatershedManagement,< Colorado State University, 1994.
2. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
3. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
4. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.
5. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.
6. V.P. Singh & Donald K. Frevert "Watershed Models" Taylor & Francis
7. E.M. Tideman "Watershed management :Guidelines for Indian Conditions" Omega Scientific Publishers

E-BOOKS

1. http://nptel.ac.in/syllabus/105101010/
2. http://nptel.ac.in/syllabus/105107068/

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DEPARTMENT OF CIVIL

Course Name	REINFORCED EARTH STRUCTURES	Course Code	16CV8DERES	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OBJECTIVES:

To provide basic knowledge of Reinforced Earth structures, materials used, their propertiesand the design procedures for Reinforced Earth retaining walls and roads.

COURSE OUTCOME:

An ability to

CO1: Explain the basic concepts and components of Reinforced Earth constructions.

CO2: Classify geosynthetic materials, and outline their properties

CO3: Design Reinforced Retaining walls and pavements; summarize various applications of geosynthetics in civil Engineering

INTRODUCTION:

Historical background, development of concept of reinforced soil, Mechanism of reinforced soil, advantages of reinforced earth structure over similar structures. **03 Hours**

BASIC COMPONENTS OF REINFORCED SOILWALL:

Introduction, general, Soil or fill-matrix- choice of soil, backfill criteria. Reinforcement bars, Metallic strips, Metallic grids, sheet reinforcement.

Facing Elements- metal facing and concrete panel facing. **03 Hours**

MATERIALS:

Introduction and overview, Historical developments, Recent developments. Classification based on materials, Geosynthetics – geotextiles, geogrids, geomembranes, geocomposites, geonets and other products, geomats, geomeshes, geowebs, natural geotextiles, basic functions etc. **06 Hours**

PROPERTIES, TESTING & EVALUATION OF GEOSYNTHETICS:

Physical properties- (type of structure, specific gravity, mass per unit area, thickness and stiffness).

Mechanical properties- (index and performance properties)-tensile properties (grab tension test); compressibility property; seam strength; burst strength; tear strength and puncture strength; friction; pull out resistance.

Hydraulic properties-porosity; percentage open area; apparent opening size; permittivity; transmissivity; soil retention.

Endurance properties- Installation damage; creep and stress relaxation; abrasion and clogging;

Degradation of geosynthetics due to temperature, oxidation, hydrolysis, chemical action and ultraviolet Testing & Evaluation- Hydrodynamic sieving test, Permeability test, Transmissivity test, Geotextile-Soil Filtration test etc. **09 Hours**

DESIGN OF REINFORCED EARTH STRUCTURE:

Introduction, principles of design, Internal and external stability, Design of retaining walls using metallic strips , Design of pavement using geogrids, concepts of embankments on soft soil , reinforced soil slopes, and bearing capacity improvement. **12 Hours**

APPLICATION OF GEOSYNTHETICS:

Use of geosynthetics in Civil engineering for filtration and drainage, uses in roads, use in landfills, Future trends in geosynthetic applications-Combined geosynthetics, smart geosynthetics, active geosynthetics, Case studies. **06 Hours**

TEXT BOOKS:

1. Designing with Geosynthetics- Koerner. R.M. - Prince Hall Publication, 1994.
2. Reinforced soil and its Engineering Applications – Swami Saran., I.K. International Pvt. Ltd.

REFERENCE BOOKS:

1. Earth reinforcement and Soil structure- Jones CJEP- Butter worths, London, 1996.
2. Earth Reinforcement Practices - Hidetoshi Octial, Shigenori Hayshi & Jen Otani - Vol. I, A.A. Balkema, Rotterdam, 1992.
3. Reinforced Earth- Ingold, T.S. - Thomas, Telford, London.
4. Geosynthetics in Civil Engineering – Edited byR.W. Sarsby, CRC Press, Boca Raton.
5. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.

E-Resources: Nptel courses: http://nptel.ac.in/downloads/105106052/

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DEPARTMENT OF CIVIL

Course Name	URBAN TRANSPORT PLANNING	Course Code	16CV8DEUTP	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3-0-0-0	3 Hours	50+50

COURSE OUTCOME:

An ability to

CO1: Outline the types of surveys to provide the data required for transportation planning

CO2: Develop trip production models & compute trip attraction rates

CO3: Develop various trip distribution models & calibrate using gravity model

CO4: Build aggregate mode split models & analyse transportation network flows

CO5: Discuss characteristics of mass transit systems

INTRODUCTION:

Characteristics of different modes of transportation; Principles of co-ordination and operation control, Elements in urban transit system **03 Hours**

TRANSPORTATION PLANNING PROCESS:

Interdependence of Land Use and Traffic, Systems Approach, Stages in Transport Planning. **04 Hours**

TRANSPORT SURVEYS:

Study Area, Zoning, Planning of different types of surveys and interpretation, travel demand; Traffic surveys for mass transit system planning. **08 Hours**

TRIP GENERATION:

Trip Purpose, Factors governing Trip Production and Attraction, Trip Production Models, Category Analysis. **06 Hours**

TRIP DISTRIBUTION:

Methods of trip distribution, Application of gravity model, Calibration of gravity model, Problems. **08 Hours**

MODAL SPLIT AND TRIP ASSIGNMENT:

Factors affecting modal split; Modal split in transport planning; Purpose of Trip Assignment, principles of traffic assignment; Assignment techniques **06 Hours**

MASS TRANSIT SYSTEMS: -

Types-characteristics-objective and Planning- Current developments in India 04 Hours

Text Books:

1. Kadiyali, L.R., 'Traffic Engineering and Transportation Planning' – Khanna Publication, 2011.
2. C. Jotin Khisty & B. Kent Lall, "Transportation Engineering-An Introduction", Prentice Hall of India Private Limited, Third Edition, New Delhi, 2006.

REFERENCE BOOKS:

Adib Kanafani, "Transportation Demand Analysis", McGraw Hill Book Company, New York.
Juan de Dios Ortuzar& Luis G. Willumsen, "Modelling Transport" 4th Edition, Wiley

E-BOOKS

nptel.ac.in/courses/105107067/
nptel.ac.in/downloads/105106058/

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DEPARTMENT OF CIVIL

VIII SEMESTER CIVIL ENGINEERING

Subject	INDUSTRIAL TRAINING	Sub. Code	16CV8DCITP
Credit	2	CIE +SEE	50 +50

All the students are encouraged to undergo a minimum of 4 weeks industrial training in an ongoing construction project and submit a report consisting the details of the organization, project details and specific construction aspect which they have learnt during that period for CIE and SEE to be recognized as an credit course.

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DEPARTMENT OF CIVIL

Subject	MAJOR PROJECT Phase -2	Sub. Code	16CV8DCMAP
Credit	11	CIE +SEE	100 +100

Course Outcomes:

CO1: Identify a current problem through literature/field./case studies and define the background objectives and methodology for solving the same.

CO2: Analyse, design and develop a technology/process

CO3: Implement and evaluate the technology at the laboratory level

CO4: Write report and present it effectively.

The Phase II of the project shall consist of

- Experimental design/set-up
- Experimental work/studies
- Report Writing
- Evaluation of project report by the internal /external guides

May be carried out using in-house facilities or in an industry by specified number of students in a group.

HSS ELECTIVE
VIII SEM

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DEPARTMENT OF CIVIL

Course Name	LAW FOR ENGINEERS	Course Code	16HS8DELFE	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-0-1	3 Hours	50+50

Course Objective

To examine and review the laws complying with environment, health andsafety.

Course Outcomes

After the completion of the course the students will be able to

CO1: Enumerate the principles of sustainable development.

CO2: Discuss the significance of various legislations pertaining to civil engineering.

Environmental Law Origin of Environmental Law, Concept of Pollution – Sources of Pollution, Types of Pollution, and Effects of Pollution. Nature and Scope of Environmental Law – Importance. Case study. **06 Hrs**

Labour Law

Provisions of various labor laws-Workmen's Compensation Act 1923;Disablement, Total Permanent disablement, Temporary disablement, Formula for compensation; Minimum wages act, 1948; Payment of bonus Act, 1965; Weekly holidays Act, 1942; Payment of Wages Act, 1936; Employees Insurance Act, 1948. **08 Hrs**

Indian Penal Code

A brief introduction to criminal liability of civil engineers in constructions as per the Indian Penal Code. **06 Hrs**

IPR and Law of Torts

Definition, categories of torts, Breach of Duty and Damages. **06 Hrs**

Text/Reference books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. Ratanlal and Dhirajlal &: The Law of Torts.
3. S. Shantha Kumar- Introduction to Environmental Law.
4. Madhavan Pillai - Labour and Industrial Laws.
5. Bare Acts referred to above.

Reference books:

1. VR. KrishnaIyer-Environmental pollution and the law.
2. Suresh Jain and Vimal Jain- Environmental law in India.
3. Goswami VG- Labour and Industrial law.
4. Indian law Institute- Law and labour management relations in India.
5. Avtar Singh- The law of torts.

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DEPARTMENT OF CIVIL

Course Name	MANAGEMENT AND ENTREPRENEURSHIP	Course Code	16HS8DEMAE	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-0-1	3 Hours	50+50

COURSE OBJECTIVES:

To prepare students with broad understanding of business as well as more focused learning in key management areas. The course also equip the students to think like entrepreneurs.

COURSE OUTCOMES: An ability to,

CO1: Discuss the importance of management and its approaches.

CO2: Explain the various features and environment of management process.

CO3: Summarize types, characteristics, schemes, and policies of entrepreneurship

CO5: State various funding support available to entrepreneurs.

CO6: Prepare project reports for decision making.

PART - A (MANAGEMENT)

UNIT – 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Evolution of Management Thought. Management as a science or art of profession. Scope and functional areas of management. **02 Hrs**

UNIT – 2

Functional areas of Management: Planning - Nature, Planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans. **10Hrs**

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization – Types of organization - Departmentation - Committees – Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing.

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Communication - Meaning and importance –Coordination, meaning and importance and Techniques of Co -ordination. Meaning and steps in controlling - Essentials of a sound control system.

UNIT – 5

ENTREPRENEUR: Entrepreneurship- definition. Types of Entrepreneur, Intrapreneur. Growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry

10 Hours

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

Laws Concerning Entrepreneur: partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries.

UNIT-8PREPARATION OF PROJECT : Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

04 Hrs

RECOMMENDED BOOKS:

1. Principles of Management – P.C. Tripathi, P.N. Reddy – Tata McGraw Hill, 2007.
2. Dynamics of Entrepreneurial Development & Management – Vasant Desai:, Himalaya Publishing House, 2007.
3. Management Fundamentals Concepts, Application, Skill Development – Robert Lusier –Thompson, 2007.

REFERENCE BOOKS:

1. Entrepreneurship Development – Poornima M Charanthimath Pearson Education 2006.
2. Entrepreneurship and management - Shashi k Gupta- Kalyani publishers, Latest edition.

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DEPARTMENT OF CIVIL

Course Name	BASICS OF MARKETING AND SALES	Course Code	16HS8DEBMS	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-0-1	3 Hours	50+50

COURSE OBJECTIVES:

To prepare students with basic knowledge in Marketing and Sales

COURSE OUTCOMES:

Upon successful completion of the course the student will be able to

CO1: Outline the basic principles of marketing and sales

CO2: Discuss strategies and types of marketing and pricing of new products

CO3: Explain concepts of sales management and role of sales manager

CO4: Demonstrate knowledge of online marketing

CO5: Exemplify related case studies

Introduction to Marketing: 5 Hours

Definitions of market, marketing, Marketing Management Orientation- production, product, selling, marketing and societal marketing, marketing environment, marketing research

Customer driven Marketing strategy & mix 7 Hours

Market Segmentation- bases, Market targeting- strategies, Positioning, basics of Marketing mix – product- levels, Individual product and service decisions, price- broad categories of new product pricing, place- channel member tasks and channel levels, promotions- the promotion mix

Introduction to sales Management 6 Hours

Meaning, Importance, Personal selling, Trends in Sales management, qualities and responsibilities of a sales manager, selling skills, selling process

Online Marketing & Selling on the Internet **6 Hours**

Marketing and the Internet, Online Marketing Domains, Online Marketing Presence, internet based selling- Internet trading in India

Case studies **2 Hours**

Case studies pertaining to Indian and global contest

TEXT BOOKS

1. Marketing Management: A South Asian Perspective, Kotler , Keller, Koshy&Jha, 13/e, , 2012, Pearson.
2. Sales Management, Tapan Panda & Sunil Sachdev, 6/e, 2003, Oxford University Press.

REFERENCE BOOKS:

1) Marketing Management: A Strategic Decision Making Approach, Ramaswami Namakumari, 5/e, 2013, Mc Graw Hill Education
2) Marketing, Etzel, Stanton, Walker&Pandit, 14/e, 2009, McGraw Hill Education
3) Principles of Marketing Management, Kotler, Armstrong, Agnihotri, Haque, 13/e, 2010, Pearson
4) Sales Management: Teamwork, Leadership and Technology, Charles, Futurell, 6/e, 2001, Thomson South Western
5) Sales & Distribution Management, Havaldar and Cavale, 2/e, 2011, McGraw Hill Education

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DEPARTMENT OF CIVIL

Course Name	ECONOMICS FOR ENGINEERS	Course Code	16HS8DE EFE	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-0-1	3 Hours	50+50

COURSE OBJECTIVES:

To familiarize students with of the basic concepts of economics, understand the micro and macro aspects and to apply them in the Engineering profession.

COURSE OUTCOMES:

An ability to,

CO1: Comprehend basic principles of Economics in Engineering.

CO2: Explain the fundamental concepts of supply and demand and apply them for functioning of a firm and industry in civil engineering.

CO3: Perform cost and production analysis, assess profits, calculate BEP and Payback period for decision-making.

CO4: Discuss concepts of macroeconomics and identify indicators to evaluate the economics in construction industry.

CO5: Explain Banking and financial system and related policies

CO6: Outline the importance of public Economics, Welfare, and Distribution of Wealth.

Introduction to Economics

Economics – Meaning, Nature, Scope and Significance, Micro and Macro Economics, the Logic of Economics.The three problems of Economic Organization, Society's technological possibilities, Market Mechanism.

Self-Study: The role of Government in a mixed economy **4 Hrs**

Fundamental Concepts, Supply and Demand

Opportunity Cost, Equi-Marginal Principle, Time perspective, Incremental Concept, Time

Value of Money, The Demand Schedule, Supply, Equilibrium, Law of Demand, Elasticity of Demand, Law of Supply, Factors Affecting Demand and Supply. **6 Hrs**

Self-Study: Demand and Supply in Construction industry.

Cost Analysis and Production Analysis

Concepts, Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve. Concepts, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Economies of scale, Diseconomies of scale. Break Even Analysis – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions. **6 Hrs**

Self-Study: Opportunity Costs and Markets

Macro Economics

Concepts, Aggregate Demand and Supply, Measuring Economy, GDP, Money Supply, Interest Rates, Consumption, Savings, Investment, Business Cycles **4 Hrs**

Self-Study: Economic cycles in India and Construction Industry

Money and Financial System

Financial System, Banking, Capital Market, Central Bank and Functions, Monetary Policy, Fiscal Policy, EX-IM Policy, Industrial policies of the past and present. **4 Hrs**

Self-Study: LPG Policy and developments in infrastructure sector.

Economic Growth

Population Growth and Development, Unemployment, Economic Consequences of Government Debt, Stabilizing the economy, Economic Growth and Human Welfare **2 Hrs**

Self-Study: Technological Advances and Economic Growth

TEXT BOOKS

1) Indian Economy, Datt and Mahajan, 64^{th} revised edition, 2012, S.Chand
2) Economics, Samuelson and Nordhaus, 19^{th} edition, 2010, McGraw Hill Education – India

REFERENCE BOOKS:

1) Principles of Economics, Mankiw Gregory N., 2002, Thompson Asia
2) Managerial Economics, V. Mote, S. Paul, G. Gupta, 2004, Tata McGraw Hill
3) Indian Economy, Misra, S.K. and Puri, 2009, Himalaya
4) Textbook of Business Economics, PareekSaroj, 2003, Sunrise Publishers

NOTE

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

Semester: III (Admission year: 2014 onwards)

Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours
			L	T	P	S		
15MA3GCMAT	Engineering Maths –III (BS)	MATHS	3	-	-	-	3	3
15CV3DCBMC	Building Materials & Construction (ES)	CIVIL	3	-	-	-	3	3
15CV3DCGEO	Engineering Geology (BS)	CIVIL	2	-	1	2	5	4
15CV3DCBSY	Basic Surveying (ES)	CIVIL	2	-	1	2	5	4
15CV3DCMOF	Mechanics of Fluids (ES)	CIVIL	3	1	-	-	4	5
15CV3DCSOM	Strength of Materials (ES)	CIVIL	3	1	1	-	5	7
			Total Credits				25	26

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

Semester: IV (Admission year: 2014 onwards)

Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours
			L	T	P	S		
15MA4GCMAT	Maths (BS)	MATHS	3		-	-	3	3
15CV4DCSTA	Structural Analysis (ES)	CIVIL	3	1	-	-	4	5
15CV4DCCON	Concrete Technology (ES)	CIVIL	2	-	1	2	5	4
15CV4DCASY	Advanced Surveying (ES)	CIVIL	2	-	1	-	3	4
15CV4DCSME	Soil Mechanics (ES)	CIVIL	2	1	-	-	3	4
15CV4DCHYM	Hydraulics & Hydraulic Machines (ES)	CIVIL	2	-	1	-	3	4
15CV4DCBPD	Building Planning & Drawing (ES)	CIVIL	1	-	1	2	4	4
			Total Credits				25	28

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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				**25**	**26**			**700**

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

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

VI SEMESTER B.E

Code	Course Title	Teaching Department	Credits				Credits	Contact Hours/ Week	**CIE marks**	**SEE marks**	**TOTAL MARKS**
			L	T	P	S					
16CV6DCDSS	Design Of Steel Structures	CIVIL	3	1			**4**	5	50	50	100
16CV6DCDRC	Design of RC Structures	CIVIL	3	1		-	**4**	5	50	50	100
16CV6DCWWT	Waste water Treatment	CIVIL	2	-	1	2	**5**	4	50	50	100
16CV6DCESP	Extensive survey project	CIVIL	1	-	1	2	**4**	3	50	50	100
16CV6DCSWL	Software Applications lab	CIVIL	1	-	1	-	**2**	3	50	50	100
16CV6DE---	DEC-2	CIVIL	3	-	-	-	**3**	3	50	50	100
16CV6DE---	DEC-3	CIVIL	3	-	-	-	**3**	3	50	50	100
						Total	**25**	**26**			**700**

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

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

Department Electives

	Course Code	**Course Title**	**Teaching Department**	CREDITS				**Contact Hours/ week**	**CIE marks**	**SEE marks**	**Total marks**
				L	T	P	Total				
DEC-2	**16CV6DETOE**	Theory of elasticity	CIVIL	3	-	-	**3**	3	50	50	100
	16CV6DEGIT	Ground Improvement Technique	CIVIL	3	-	-	**3**	3	50	50	100
	16CV6DESWM	Solid Waste Management	CIVIL	3	-	-	**3**	3	50	50	100
	16CV6DEPMC	Pavement Materials & Construction	CIVIL	3	-	-	**3**	3	50	50	100
DEC-3	**16CV6DEIHS**	Irrigation and hydraulic structures	CIVIL	3	-	-		3	50	50	100
	16CV6DEERS	Earth Retaining Structures	CIVIL	3	-	-	**3**	3	50	50	100
	16CV6DESMA	Structural Masonry	CIVIL	3	-	-	**3**	3	50	50	100
	16CV6DEPAD	Pavement Design	CIVIL	3	-	-	3	3	50	50	100

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

(**Admission year 2014 onwards**) **VII SEMESTER B.E**

Course Code	**Course Title**	**Teaching Department**	**Credits**				**Total Credits**	**Contact Hours**	**MARKS**			**SEE DURATION Hours**
			L	T	P	S			CIE	SEE	TOTAL	
16CV7IE---	IEC-1	-------	3	-	-	-	**3**	3	50	50	100	3
16CV7DCDDG	Design & Drawing of RCC & Steel Structures	CIVIL	3	0	1		**4**	5	50	50	100	**4**
16CV7DCPSC	Analysis and Design of Pre-stressed concrete members	CIVIL	4	0	-		**4**	4	50	50	100	3
16CV7DCQSC	Quantity Surveying & Costing	CIVIL	3	1	-	2	**6**	5	50	50	100	**4**
16CV7DCTRS	Transportation Systems	CIVIL	3	0	-	-	**3**	3	50	50	100	3
16CV7DE----	DEC-4	CIVIL	3	-	-	-	**3**	3	50	50	100	3
16CV7DCMAP	Major Project (Phase-1)	CIVIL			-	-	**2**	-	50	50	100	
			Total Credits				**25**	**23**			**700**	

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VII SEMESTER

INSTITUTIONAL ELECTIVE- IEC-1

Subject Code	Course Title	Teaching Department	Credits			Total Credits	Contact Hours
			L	T	P		
16CV7IERSG	Remote Sensing & Geographical Information System	CIVIL	3	-	-	3	3
16CV7IEFEA	Finite Element Method of Analysis	CIVIL	3	-	-	3	3

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

(Admission year 2014 onwards) **VII SEMESTER-DEPARTMENT ELECTIVES**

Course Code	Course Title	Teaching Department	Credits			Total Credits	Contact Hours	Marks		
			L	T	P			CIE	SEE	Total
16CV7DEADR	Advanced Design of RC Structures	CIVIL	3	-	-	**3**	3	50	50	100
16CV7DEAFD	Advanced Foundation Design	CIVIL	3	-	-	3	3	50	50	100
16CV7DEGDR	Geometric Design of Roads	CIVIL	3	-	-	3	3	50	50	100
16CV7DEGHY	Ground Water Hydrology	CIVIL	3	-	-	3	3	50	50	100
16CV7DEIWW	Industrial Waste Water Treatment	CIVIL	3	-	-	3	3	50	50	100
16CV7DEDDB	Design and drawing of Bridges and Irrigation Structures	CIVIL	2	-	1	3	4	50	50	100
16 CV7DESDY	Structural Dynamics	CIVIL	2	1	-	**3**	3	50	50	100

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

(Admission year 2014 onwards) **VIII SEMESTER B.E**

Subject Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours	Marks			
			L	T	P	S			CIE	SEE	MARKS	SEE DURATION HRS
16CV8IE---	IEC-2	-	3	-	-		**3**	3	50	50	100	3
16CV8 HS CMF	Construction Project management, finance and professional ethics (HSS CORE)	CIVIL	2	-	-	1	**3**	2	50	50	100	3
16CV8DE---	Dept. Elective - 5 (DEC-5)	CIVIL	3	-	-		**3**	3	50	50	100	3
16HS 8 DE ---	HSS ELECTIVE	-	2	-	-	1	**3**	2	50	50	100	3
16CV8DCMAP	Major Project (Phase-2)	CIVIL					**11**	-	100	100	200	-
***16CV8DCITP**	Internship/Industrial Training	CIVIL	-	-	-		**2**	-	50	50	100	-
			Total Credits				**25**	**10**			**700**	

BMS COLLEGE OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING

VIII SEMESTER-INSTITUTIONAL ELECTIVE

Subject Code	Course Title	Teaching Department	Hrs/week			Total Credits	Contact Hours
			L	T	P		
16CV8IEOSH	Occupational Safety and Health Administration	CIVIL	3	-	-	3	3

NOTE:

16CV8DMITP – Mandatory Course of Industrial training internship (to be completed either during the vacation of 6^{th} & 7^{th} semester or 7^{th} & 8^{th} Semester for a minimum period of 4 weeks. Students shall apply reasoning based on the solutions provided in the civil Engg construction projects and assess issues related to societal, health, safety, legal and cultural issues as applied to civil engineering practice.

16CV8DEINS: Independent study for one or two credits can be offered additionally to those students who fall short of minimum 200 credits.

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(Admission year 2014 onwards) **VIII SEMESTER B.E -DEPARTMENT ELECTIVE**

Subject Code	Course Title	Teaching Department	Credits			Total Credits	Contact Hours
			L	T	P		
16CV8DEERD	Earthquake Resistant Design of Structures	CIVIL	3	-	-	3	3
16CV8DEEIA	Environmental Impact Assessment	CIVIL	3	-	-	3	3
16CV8DEGEE	Geotechnical Earthquake Engineering	CIVIL	3	-	-	3	3
16CV8DEIWM	Integrated Watershed Management	CIVIL	3	-	-	3	3
16CV8DERES	Reinforced Earth Structures	CIVIL	3	-	-	3	3
16CV8DEUTP	Urban Transport Planning	CIVIL	3	-	-	3	3

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(Admission year 2014 onwards) VIII Sem B.E HSS ELECTIVE

Subject Code	Course Title	Teaching Department	Credits				Total Credits	Contact Hours	MARKS		
			L	T	P	S			CIE	SEE	TOTAL
16HS8DE LFE	Law for Engineers	Humanities	2	-	-	1	3	2	50	50	100
16HS8DE BMS	Basics of marketing and sales	MBA	2	-	-	1	3	2	50	50	100
16HS8DE EFE	Economics for Engineers	MBA	2	-	-	1	3	2	50	50	100
16HS8DEMAE	Management and Entrepreneurship	MBA	2	-	-	1	3	2	50	50	100

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DEPARTMENT OF CIVIL ENGINEERING

Course Name	**Engineering Maths –III**	Course Code	**15MA3GCMAT**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3-0-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

The purpose of the course is to make the students well conversant with Fourier- Series, Fourier Transforms, formulate physical problems in terms of Partial Differential Equations, find insight into the physical behaviour of systems from mathematical solution and develop computational skills using efficient numerical methods for problems in science and engineering.

COURSE OUTCOMES:

CO 1: Express given functions to form Fourier series.

CO 2: Demonstrate an understanding of Fourier transforms techniques.

CO 3: Employ analytical techniques to solve partial differential equations with appropriate boundary conditions.

CO 4: Compute the solution of a system of algebraic equations

CO 5: Use calculus of variations to find the extremal of a functional

MATRICES:

Introduction: Elementary row transformations, Echelon form of a matrix, rank of a matrix by elementary row transformations.

Consistency of system of linear equations and solution. Solution of a system of non-homogenous equations: Gauss elimination method, LU decomposition method, Gauss-Seidel method. Eigenvalues and eigenvectors of matrices.

Applications: Stability of a system of differential equations- an eigenvalue problem.

Suggested Reading: Inverse of a matrix using Gauss-Jordon method. Eigen value and corresponding eigenvector using Rayleigh power method, reduction of matrix to diagonal form.

7 Hours

FOURIER SERIES:

Introduction: Periodic function, Dirichlet’s conditions, statement of Fourier Theorem, Fourier series of periodic function of period 2π and arbitrary period, practical harmonic analysis.

Applications: Fourier series of typical waveforms used in communication engineering-saw toothed waveform, triangular waveform, square waveform, half-wave rectifier, full wave rectifier and modified saw tooth waveform.

Suggested Reading: Half range Fourier series, Fourier series of discrete functions, Complex Fourier series. **7 Hours**

FOURIER TRANSFORMS:

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms,

Suggested Reading: Convolution theorem, Fourier transforms of the derivatives of a function, Parseval's identities and physical significance of Parseval's identities. **7 Hours**

PARTIAL DIFFERENTIAL EQUATIONS:

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- The linear equation $P\,p + Q\,q = R$ (Lagrange's partial differential equation).

Applications: One-dimensional heat equation and wave equation (without proof), various possible solutions of these by the method of separation of variables.

Suggested Reading: Direct integration method, method of separation of variables, D'Alembert's solution of wave equation. **8 Hours**

CALCULUS OF VARIATIONS:

Variation of function and functional, Euler's equation, variational problem, isoperimetric problems

Applications: Geodesics of a right c ircular cylinder, minimal surface of revolution, hanging cable. Brachistochrone problem.

Suggested Reading: Minimal surface of revolution, Geodesics of a right circular cone and sphere **7 Hours**.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 40^{th} edition, 2007, Khanna Publishers.
2. Advanced Engineering Mathematics, 5th edition by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics, Glyn James, 3^{rd} edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.

3. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
4. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition Vol.1 and Vol.2, 2014, Wiley-India.

EXPERIMENTS/EXERCISES:

- Solution of system of algebraic equations using Gauss Seidel method
- LU decomposition of matrices.
- Eigenvalues and eigenvectors of matrices-stability of a system of differential equation-Eigenvalue problem.
- Largest eigenvalue and corresponding eigenvector of a matrix.
- Diagonalisation of matrices

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Course Name	**Building Materials and Construction**	Course Code	**15CV3DCBMC**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3-0-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable students to gain knowledge on various materials and processes involved in building construction. This will enable the students to apply the knowledge for building planning and drawing.

COURSE OUTCOMES:

CO1: Describe the physical and mechanical properties of a variety of construction materials.

CO2: Describe the functional components of a building.

CO3: Describe the construction process of various components of a building.

INTRODUCTION TO BUILDING MATERIALS

Physical and mechanical properties, parameters to define strength, durability and performance for the following materials.

STRUCTURAL CLAY PRODUCTS: Bricks, types of bricks, manufacturing process of bricks.

NATURAL STONE: Types, qualities of good stone for construction.

TIMBER: Natural Timber, properties, Timber products.

LIME AND CEMENT: Properties and manufacturing process.

OTHER BUILDING MATERIALS: Iron and Steel, Paints and enamels, water proofing materials

12 hours

INTRODUCTION TO BUILDING CONSTRUCTION:

Building components viz. foundations, walls, lintels roofs, openings, framed structures and masonry structures.

FOUNDATION

Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations. **3 hours**

MASONRY

Definition of terms used in Masonry, Classification of Masonry, Bonds in Brick work, Reinforced Brick Masonry, Joints in stone masonry, Introduction to load bearing, cavity and partition walls. **4 hours**

DAMP PROOFING, WATER PROOFING AND ANTITERMITE TREATMENT

Definition of technical terms, Defects, causes and sources of dampness, damp proofing and terrace water proofing methods, Pre and post constructional antitermite treatment. **3 hours**

DOORS AND WINDOWS

Definition of technical terms, Location of doors and windows, Types of Doors, Types of windows. **3 hours**

ARCHES, LINTEL AND BALCONY

Elements of an arch, Classification of arches, Definition and classification of Lintels, Definition and functions of Chejja, Canopy & Balcony **3 hours**

ROOFS AND FLOORS

Types of Roofs & Roofing materials, Types of flooring, Factors affecting selection of flooring materials, Flat roof (RCC), Types of pitched roofs. **5 hours**

STAIRS

Definition of technical terms, Requirements of good stair, Types of Stairs, Geometrical design of RCC Dog legged (Plan and sectional elevation). **3 hours**

PLASTERING AND PAINTING

Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering, Introduction to Paintings, Purpose of Painting and Defects in Painting. **3 hours**

TEXT BOOKS:

1. **A Text Book Building Materials**, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication., 2nd Edition,.2015
2. **Building Construction,** Sushil Kumar, Standard Publication and Distributors, New Delhi, 19th Edition, 2001.

REFERENCE BOOKS:

1. **Advances in Building Materials and Construction** by Mohan Rai and M.P. Jain Singh – publication by CBRI, Roorkee.
2. **Building Materials (3rd revised edition)**, S.K. Duggal, New Age International publishers, India.
3. **Building Construction**, by Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain,Laxmi Publications Pvt Ltd.

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Course Name	**Engineering Geology**	Course Code	**15CV3DCGEO**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**2-0-1-2**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

1. Study of internal structure of the earth.
2. Identification and description of Minerals and Rocks based on their index properties.
3. Study of structural features (Folds, Faults, and Joints etc) of the rocks and earth and their engineering consideration.
4. Study of various Geological Maps.
5. The study of Geotechnical and groundwater potential Zones using various Techniques.
6. The study and select good building stones, sites for construction of dam, reservoir, wells and tunnels.

COURSE OUTCOMES

CO1: Explain the structural features of the earth. Identify and classify minerals and rocks.

CO2: Provide decision support on Lithological characters and related groundwater conditions.

CO3: Describe various geological maps and interpretation of geological data for tunneling, mining and mineral excavations.

CO4: Identify the suitable site for the Civil Engineering project by providing remedial measures in the structurally disturbed areas with the help of Geological investigation.

INTRODUCTION:

Introduction to Geology and its importance in Civil Engineering practices. Internal structure and composition of the earth.

MINERALOGY:

Study of rock forming and economically important minerals. Physical properties, chemical composition, uses and contribution of the following minerals in preparation of construction materials - : Quartz and its varieties: Feldspar group: Mica Group: Carbonate group: Calcite, Asbestos, Kaolin and Garnet. Ore minerals: Hematite, Magnetite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena and Bauxite. **5 Hours**

PETROLOGY:

Introduction, Rock cycle and study of the following Rocks.

IGNEOUS ROCKS:

Definition, origin, classification, and forms of Igneous Rocks. Texture structure, Petrological description and Engineering importance of the following rocks: Granite Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite and Basalt.

SEDIMENTARY ROCKS:

Definition, origin, classification of Sedimentary rocks. Primary structures Petrological description and engineering importance of the following Rocks. Conglomerate Breccia, Sand Stone, Shale, Limestone and Laterite.

METAMORPHIC ROCKS:

Definition, types of Metamorphism, Metamorphic structures. Petrological, description and Engineering importance of the following rocks. Slate, Schist, Gneiss, Quartzite, and Marble.Weathering and deterioration of rocks. Types and agents of weathering. **6 Hours**

APPLIED GEOLOGY:

Selection of rocks for foundation, construction, cladding, flooring, concrete aggregate, road metal, and railway ballast with examples, Site selection for Dams, Reservoirs, and Tunnels. Silting up of reservoir and remedial measures.

GEODYNAMICS:

Dynamic activities of the Earth, Plate tectonics. Geological and Engineering considerations of Land slide, (mass movements) Avalanches causes and precautions. Earthquakes - seismic waves, seismic zones, causes and effects. **10 Hours**

STRUCTURAL GEOLOGY (ROCK MECHANICS):

Introduction, Stress and Strain in rocks, Outcrop, Dip and Strike, and Compass clinometers. Study of structural features of rocks. Description of Folds, Faults and Joints, their identification in the field. Importance in various Civil Engineering projects. **5 Hours**

HYDROGEOLOGY:

Introduction, Study of Groundwater and its importance, Occurrence of groundwater in different Geological rock formation, Water table, Water level fluctuation. Types of Aquifers- Confined and unconfined Aquifers, Artificial recharge of ground water. Selection of well sites, Geological and Geophysical Methods of Groundwater exploration and Applications of Electric resistivity method. **6 Hours**

Lab components must comprise of experiments that reinforce the theoretical understanding of the corresponding theory subject. Outlines of the laboratory components should be mentioned by the respective staff members well before the commencement of the course.

TEXT BOOKS:

1. A Text of Engineering and General Geology, By Parbin Singh, 2009
2. A Text of Geology, by P.K. Mukherjee, 2006

REFERENCES:

1. A Text of Engineering and Geology, by B.S. Sathyanarayanaswamy
2. Physical Geology, By Arthur Homes
3. Principle of Engineering Geology, by KVGK Gokhale
4. Principle of Engineering Geology, by K.M. Bangar
5. Physical and Engineering Geology, by S.K. Garg
6. Geology for Engineers, By D.S. Arora
7. Engg Geology by S K, Duggalet. Al
8. Engineering Geology by D.Venkatareddy
9. Ground water Geology by Todd D.K. Jhon Willey and Sons, New York

LEARNING RESOURCES:

1. www.geoscienceworld.org
2. www.springer.com
3. http://en.wikipedia.org
4. www.gle.wisc.edu
5. www.geoexpro.com
6. http://freevideolectures.com/Course/87/Engineering-Geology

EXPERIMENTS/EXERCISES:

1. **MINEROLOGY: Study of Physical Properties of the mineral and their contribution in preparation of construction materials**
   - **Practical no. 1: Study of the Physical Properties of the following minerals**.
   - **Quartz group of Minerals:-** Rock crystal, Rose Quartz, Jasper banded Agate/Jasper, Smoky Quartz
   - **Feldspar Group:** Orthoclase, Plagioclase, Microcline.
   - **Mica Group:** Biotite Mica, Muscovite mica.
   - **Practical no. 2: Study of the Physical Properties of the following minerals.**
   - **Carbonate Group:** Calcite, Magnesite, Dolomite.
   - **Ferro-Magnesium Minerals:** Hornblende, Augite, Olivine, Asbestos, Talc, Garnet, Gypsum

- **Practical no.3: Study of the Physical Properties of the following minerals**
- **<u>Ore Minerals:</u>** Hematite, Magnetite, Limonite, Iron Pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena, Bauxite.

2. **PETROLOGY: Identification of Rocks Based on their Index Properties**
   - **Practical no.4: Igneous Rocks:** Granite, Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite and Basalt.
   - **Practical no. 5: Sedimentary Rocks:** Conglomerate, Breccia, Sandstone, Shale, Limestone and Laterite.
   - **Practical no. 6: Metamorphic Rocks:** Slate, Schist, Gneiss, Quartzite, and Marble.
3. **STRUCTURAL GEOLOGY (ROCK MECHANICS):**
   - **Practical no. 7:** Analysis and understanding of the Lithological Character of sub surface by Vertical Electrical Sounding (VES) resistivity method.
   - **Practical no. 8:** Dip and Strike Problems (two types).
   - **Practical no. 9:** Borewell Problems on level Ground (two types).
   - **Practical no. 10:** Study and Interpretation of Standard Structural Geological Maps.

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III SEMESTER CIVIL ENGINEERING

Course Name	**Basic Surveying**	Course Code	**15CV3DCBSY**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**2-0-1-2**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable the students to gain knowledge in the basics of surveying and instrumentation connected with it. This enables for the understanding of the infrastructure projects.

COURSE OUTCOMES

CO1: Explain the importance and principle of surveying, different types of surveys and techniques used in surveying.

CO2: Apply different methods used for linear and angular measurements, and calculate the elevation of objects.

CO3: Explain working principle and usage of different types of modern surveying instruments.

INTRODUCTION

Definition of surveying. Historical perspective of surveying. Comparison between geometry and surveying. Necessity of surveying. Plan and maps. Classification of surveying. Basic geometrical relations used for understanding surveying. Basic measurements. Control surveys –Horizontal and vertical. Cardinal principles of surveying. Error, Accuracy and precision. Numerical problems on precision and accuracy. Map & Classification. Survey of India topographical Maps and their numbering. **5 Hours**

THEODOLITE SURVEYING

Essentials of transit Theodolite, Definitions and terms, Temporary and permanent adjustments, Measurement of horizontal and vertical angles, Fundamental lines and desired relations, Sources of error in Theodolite. **5 Hours**

TRIGONOMETRIC LEVELLING

Introduction, Base of the object accessible, Base of the object inaccessible: instruments stations in same and different vertical plane, Determination of height of an elevated object, Determination of height of an elevated object from three different stations, Numerical problems.

5 Hours

TACHEOMETRIC SURVEYING

Different types, Principles, Distance and elevation formulae for different conditions, Horizontal base substense measurements, Special instruments, Errors in stadia surveying, Numerical problems. **4 Hours**

LEVELLING

Concepts of levelling, instruments used. Terms and definitions. Reductions of level, Booking of levels, Classification of levelling. Curvature and refraction effects, Reciprocal levelling, Errors. Numerical examples on booking and reduction of levels, calculation of gradients, correction for curvature and refraction, true difference in height using reciprocal observations. Contouring, characteristics and applications. **5 Hours**

INSTRUMENTATION IN SURVEYING

Electronic Theodolites, Autolevel, Geodimeter, Tellurometer, Distomats, Total Station.

2 Hours

TEXT BOOKS:

1. Punmia. B.C., Ashok. K. Jain and Arun .K. Jain ‘Surveying Vol1, Lakshmi Publications, 2014.
2. Roy. S.K., Fundamentals of Surveying’ Prentice Hall of India, 1999, New Delhi.
3. Duggal. S.K, ‘Surveying’ Volume 1, Tata McGraw Hill, 1996, New Delhi.

REFERENCE BOOKS:

1. Kavanagh, Barry F. Surveying: Principles and Applications, 8th Edition, 2009, Prentice Hall.
2. Arthur Bannister, Stanley Raymond and Raymond Baker. Surveying, 7th Edition, Pearson Education

EXPERIMENTS/EXERCISES

1. Study of various instruments used for surveying, namely chain, tape, Compass, Dumpy level, Autolevel, Theodolite, Tacheometer, Total station and GPS
2. Study of topographic maps and preparation of a chart of conventional symbols used in toposheets.
3. To set regular geometric figures using linear measuring instruments and accessories
4. Study of prismatic compass and finding the fore bearing and back bearing of a given survey line.
5. To set regular geometric figures using prismatic compass, given the bearing of one line.

6. To find the distance between two inaccessible points using prismatic compass, chain, tape and other accessories.
7. Study of use of Dumpy level. To determine the reduced level of various points using Dumpy level.
8. To find the true difference in elevation between two points situated far apart by using reciprocal leveling.
9. To conduct profile leveling & cross-sectioning and to plot the details.
10. Leveling exercises by using Total-stations.

Course Name	**Mechanics of Fluids**	Course Code	**15CV3DCMOF**	SEE Duration	SEE+CIE
Credits	**04**	L-T-P-S	**3-1-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

- To introduce the basic concepts of fluid mechanics
- To introduce the pressure concepts, types, its determination.
- To introduce the basic concepts of fluid kinematics and fluid kinetics, their applications to civil engineering problems.
- To introduce the basic laws of fluid dynamics and their applications.

COURSE OUTCOMES:

CO1: Explain the mechanics of fluids at rest and in motion by describing and observing the fluid phenomena

CO2: Analyse fluid interactions with natural and constructed systems using the principles and laws of fluid mechanics

CO3: Apply knowledge for subsequent courses involving the analysis & design of flow related systems

INTRODUCTION:

Definition of fluid, Distinction between Solid, fluid & gases, Concept of Fluid Continuum

Fluid Properties: Mass Density, Specific Volume, Specific Weight, Specific Gravity-Definitions, Units and Dimensions, Viscosity, Newton's Law of Viscosity, Newtonian & Non-Newtonian Fluids, Ideal & Real Fluids, Compressibility, Vapor Pressure, Surface Tension, and Capillary. **4 Hours**

FLUID PRESSURE & ITS MEASUREMENT:

Definition of Pressure, Pressure at a point in a static fluid, Hydrostatic pressure law, Types of Pressures, Measurement of Pressure- Simple & Differential Manometers and Mechanical Gauge.

7 Hours

HYDROSTATICS:

Definition of Total Pressure, centre of pressure, Total pressure & centre of pressure on Vertical plane surface, Inclined & curved plane surfaces. Pressure Diagram. Practical applications- Dams & Gates. **10 Hours**

KINEMATICS OF FLUID:

Description, Continuity Equation in differential form, Velocity Potential, Stream Potential, Equipotential line, Line of constant stream line, Flow net.

Classification of fluid flow, Stream line, Streak Line, Path Line, Stream tube, Acceleration of Flow in one dimensional flow, types of accelerations. **10 Hours**

DYNAMICS OF FLUID FLOW:

Concept of Inertia force and other forces causing Motion, Derivation of Euler's & Bernoulli's Equation (Both for Ideal & Real Fluids),

Applications of Bernoulli's Equation- Venturi Meter, orifice Meter & Pitot Tube Theory. Flow through Orifices and mouth pieces, Flow over Notches and weirs. **10 Hours**

PIPE FLOW SYSTEMS:

Energy losses in pipes- introduction, Darcy- Weisbach equation, Moody diagram, Energy losses in pipe lines- minor losses, multiple pipe systems. Water Hammer in Pipes: Definition, Equation for pressure rise due to gradual closure of valve, sudden closure in rigid & plastic pipes, problems, surge tanks, types & functions **5 Hours**

Boundary layer theory and applications- concept of boundary layer and its growth.

Dimensional Analysis Introduction, Dimension, Dimensional homogeneity, Methods- Rayleigh method, Buckingham Pi method, Similitude- Geometric, Kinematic & Dynamic Similarity

6 Hours

TEXT BOOKS:

1. Fluid Mechanics including Fluid Machines– P.N.Modi & S.M.Seth, Standard Book House, New Delhi, 20th Edition, 2015

REFERENCE BOOKS:

1. Fluid Mechanics- Victor L Streeter & E. Benjamin Wylie, McGraw Hill Publications.
2. Fluid Mechanics- Frank M White, Sixth Edition, the McGraw Hill Companies.
3. Fundamentals of Fluid Mechanics- Bruce R Munson & Donald F Young, John Wiley & Sons, Inc.
4. Fluid Mechanics- K.L. Kumar, S. Chand & Company Ltd, New Delhi.
5. Fluid Mechanics & machinery – C.S.P. Ojha, R. Berndtsson & P.N. Chandramouli, Oxford University Press.
6. Fluid Mechanics- R.K. Bansal, Laxmi Publications, New Delhi.

E-Books / Resources

http://nptel.ac.in/courses/105101082/
http://elearning.vtu.ac.in/10CV35.html

BMS COLLEGE OF ENGINEERING, BANGALORE-560 019
(Autonomous College under VTU)

III SEMESTER CIVIL ENGINEERING

Course Name	**Strength of Materials**	Course Code	**15CV3DCSOM**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**3-1-1-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

After having learnt the mechanism of force transference, it is essential to know the response of the material/structure under different configuration of loading. The objectives of the course are to enable students to identify different materials and their response to loadings in terms of stresses, strains, bending moment and shear force.

COURSE OUTCOMES:

CO1: Explain stress and strain at a point and their relations in a deformable material

CO2: Apply the force equilibrium conditions and the concept of free body diagrams to determine structural responses

SIMPLE STRESSES AND STRAINS:

Introduction, Properties of Materials, Stress, Strain, Hooke's law, St. Venant`s principle, Stress–Strain Diagram for structural steel and nonferrous materials, Principles of superposition, Deformation of uniform bars, bars of varying cross ections,taperingbarsofcircularandrectangularcrosssections.Deformationduetoself–weight.

8 Hours

ELASTIC CONSTANTS:

Relationship among elastic constants, volumetric strain, Stresses in composite sections Thermal stresses (including thermal stresses in compound bars).

TRANSFORMATION OF STRESSES: Introduction, Resolution of stresses on inclined planes, General two dimensional stress system, Principal planes and Principle stresses, Plane stress and plane strain conditions, Mohr's circle of stresses

8 Hours

BENDING MOMENT AND SHEAR FORCE IN BEAMS:

Introduction, Definitions-Bending moment and Shearing force in beam, Sign convention, Relationship between loading, shear force and bending moment, SFD and BMD with salient values for statically determinate beams(cantilever Beams, simply supported beams and overhanging beams) subjected to point loads, UDL, UVL and Couple.

BENDING STRESS IN BEAMS: Introduction – Bending stress in beam, Assumptions in simple bending theory, Pure bending derivation of Bernoulli's equation, Modulus of rupture, section modulus, flexural rigidity, Variation of bending stresses across the cross section of the beams

SHEAR STRESS IN BEAMS: Expression for horizontal shear stress in beam, Shear stress diagram for rectangular, symmetrical 'I' and 'T' section (Flitched beams not included).

12 Hours

ELASTIC STABILITY OF COLUMNS: Introduction–Short and long columns, Assumptions, Euler's theory on columns, Derivation of Euler's buckling load for a column with both ends hinged Effective length slenderness ratio, radius of gyration., Limitations of Euler's theory, Rankine's formula and problems.

12 Hours

TORSION OF CIRCULAR SHAFTS:

Pure torsion, torsion equation of circular shafts, Strength and stiffness, Torsional Rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections.

THIN AND THICK CYLINDERS: Stresses in thin cylinder subjected to pressure, hoop, longitudinal and volumetric strains, Thick cylinders-Lame's equations, radial and hoop stresses (excluding compound cylinders).

6 Hours

TEXT BOOKS:

1. Mechanics of Materials by Ferdinand P. Beer and E. Russel Johnston(jr)Publisher, 6^{th} Edition, 2013
2. Strength of materials by L.S.Srinath, Prakash Desai and Ananth Ramu Publisher, 2^{nd} Edition, 2009

REFERENCE BOOKS:

1. Elements of Strength of Materials, Timoshenko and Young, Affliated East-West Press.
2. Mechanics of Materials, James M. Gere (5thEdition),Thomson Learning.
3. Strength of materials By I.B.Prasad, Khanna Publisher

LEARNING RESOURCES: NPTEL

EXPERIMENTS/EXERCISES:

1. Physical properties of Bricks and Blocks – Dimensionality, water absorption, density and Compressive strength
2. Impact test on Mild Steel (Charpy & Izod)
3. Hardness tests on ferrous and non-ferrous metals – Brinell’s, Rockwell and Vicker’s
4. Tension test on Mild steel and HYSD bars.
5. Compression test of Mild Steel, Cast iron and Wood
6. Torsion test on Mild Steel circular sections
7. Bending Test on Wood and Mild steel
8. Shear Test on Mild steel

IV SEMESTER

Course Name	**Engineering Maths-IV**	Course Code	**15MA4GCMAT**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3-0-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To prepare students with adequate knowledge in Probability and Statistics, Complex Analysis

COURSE OUTCOMES:

CO1: Calculate solutions of algebraic and transcendental equations, ordinary differential equations numerically

CO2: Compute solution of one dimensional heat and wave equation using finite difference techniques.

CO3: Construct analytic functions and evaluate real and complex integrals.

CO5: Estimate the relation between two variables and perform regression analysis.

CO6: Apply the basic principles of probability and probability distributions.

NUMERICAL METHODS:

Solution of algebraic and transcendental equations: Newton-Raphson method. Finite Differences and interpolation: Forward differences, backward differences. Newton-Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Lagrange's interpolation formula, Lagrange's inverse interpolation.

Numerical integration: Simpson's $1/3^{rd}$, $3/8^{th}$ rule, Weddle's rule.

Numerical solution of ordinary differential equations: Euler's modified method, Runge-Kutta method of fourth order.

Suggested Reading: Solution of simultaneous differential equations by Picard's method, Milne's method to solve ordinary differential equations

7 Hours

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS:

Finite-Difference formulas to partial derivatives.

Applications: Solution of one-dimensional heat equation using 2-level formula and Schmidt explicit formula and Crank-Nicolson two-level implicit formula Solution of one-dimensional wave equation using explicit three level formula.

8 Hours

COMPLEX ANALYSIS-1:

Function of a complex variable, limits, continuity and differentiability of a complex valued function, Analytic functions, properties of analytic functions, Cauchy-Riemann equations in cartesian and polar form, construction of analytic functions by Milne-Thomson method, Conformal mapping-Transformations- $w = z^2$ and $w = z + \frac{a^2}{z} \ (z \neq 0)$, Bilinear transformations.

Suggested Reading: Standard transformations $w = c + z,\ w = cz,\ w = 1/z$, properties of bilinear transformations

7 Hours

COMPLEX ANALYSIS-2:

Line integral, Problems on line integral, Cauchy's theorem, Cauchy's integral formula.
Taylor's, Maclaurin's and Laurent's series (without proof).Poles, Residues, Residue theorem (without proof).Evaluation of real definite integrals using residues - Integration around a unit circle and semicircle

Suggested Reading: Removable and essential singularities, improper real integrals with singular points on real axis.

7 Hours

STATISTICS AND PROBABILITY:

Curve fitting – Principle of least squares, fitting a straight line, fitting of a parabola, fitting of exponential curves of the form $y = a\ b^x,\ y = ae^{bx}$. Correlation and regression.

Probability distributions: Discrete distribution - Poisson distribution. Continuous distribution-normal distribution.

Suggested Reading: Fitting the curve $y = a\ x^b$, exponential distribution and uniform distribution

7 Hours

TEXT BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, 2007, Wiley-India
2. Higher Engineering Mathematics, B.S. Grewal, 40th edition, 2007, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
3. Advanced Engineering Mathematics, P. V. O' Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
4. Introductory methods of Numerical Analysis, S. S. Sastry, 3rd edition, 1999, Prentice-Hall of India.

Course Name	**Structural Analysis**	Course Code	**15CV4DCSTA**	SEE Duration	SEE+CIE
Credits	**04**	L-T-P-S	**3:1:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable the students to gain knowledge on the fundamentals of structural analysis by applying the knowledge gained through Engineering Mechanics and Strength of Materials. It enables to get the prerequisite for advanced analysis and design of structures.

COURSE OUTCOMES:

CO1: Identify forms of structures and the associated indeterminacies

CO2: Apply the force equilibrium conditions and compatibility conditions to analyze simple structures like arches, cables and evaluate structural resultants.

CO3: Apply energy principles to analyze and evaluate simple determinate structures.

Introduction to Structural Systems-Classification of structures, Structural forms, Loads, Conditions of equilibrium, Compatibility conditions, Statically determinate and indeterminate structures, degree of Static and Kinematic indeterminacy.

Analysis of Cables and Three Hinged Arches - Types of Arches, Analysis of Three hinged arches (Parabolic and Circular) with supports both at same and at different levels. Analysis of cables under point loads and UDL (supports at same level and different level)

12 Hours

Deflection of Beams- Macaulay's double integration method, Conjugate beam method and moment area method.

Consistent Deformation method; Analysis of Propped cantilever and fixed beams.

Analysis of Continuous beams: Clapeyron's theorem of three moments.

20 Hours

Strain Energy Principle-Strain energy and complimentary strain energy. Strain energy due to axial load, bending moment and shear force. Theorem of minimum potential energy, principle of virtual work. Castigliano's theorems and their applications in the analysis of beams and trusses. Maxwell – Betti theorem of reciprocal deflection.

6 Hours

Deflection of beams and trusses by Unit load method. Redundant Trusses- Analysis by unit load method.

10 Hours

TEXT BOOKS:

1. Theory of Structures Vol-1 by Pandit and Gupta, Tata McGraw Hill, New Delhi, 1st Edition
2. Basic Structural Analysis by C S Reddy, Tata McGraw Hill, New Delhi, 3rd Edition

REFERENCE BOOKS:

1. Elementary Structural analysis, Norris and Wilbur, International student edition, Tata McGraw Hill book Co, New York.
2. Structural Analysis by R C Hibler, 5th edition, Pearson Education Inc.

Learning Resources: NPTEL

Course Name	**CONCRETE TECHNOLOGY**	Course Code	**15CV4DCCON**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**2-0-1-2**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable students to have the knowledge on the ingredients for concrete preparation, properties of concrete and the testing of concrete properties in accordance with the IS codes.

COURSE OUTCOMES:

CO1: Apply the fundamental principles and procedures in making concrete

CO2: Apply basic requirements of the IS design specifications for designing concrete mixes

CO3: Assess the deterioration of concrete and test methods

CO4: Recognize the characteristics of special types of concrete

CONCRETE INGREDIENTS:

Hydraulic Cements: Manufacturing process, Chemical composition, types of cement, hydration of cement, micro structural development of Portland cement, testing of cement

Aggregates: Properties, types of aggregates, classification of aggregates, importance of grading, specific gravity, bulking, moisture content, deleterious materials, testing of aggregates, interfacial transition zone, recycled aggregates.

Water: qualities of water, use of sea water Chemical admixtures: water reducers, accelerators retarders and air entraining admixture Mineral additives; fly ash, slag, silica fume, rice husk ash, metakaolin and limestone powder

FRESH CONCRETE AND CONCRETE PRODUCTION:

Properties of fresh concrete; Workability, Factor affecting workability, measurement of workability, slump, compacting factor, Vee-Bee consistometer and flow tests, Segregation and bleeding, shrinkage, Rheology of fresh concrete, its importance and Bingham parameters Process of manufacture of concrete: Batching, mixing, transportation, placing and compaction and curing by different methods

MIX PROPORTIONING OF CONCRETE:

Concrete mix design: Concept of mix design, role of water to cement ratio, water content, other variables and exposure conditions, IS method, ACI method, numerical problems, concept of particle packing and rheology based method of mix design

HARDENED PROPERTIES AND DURABILITY OF CONCRETE:

Engineering properties of concrete; Compressive strength and the factors affecting the strength, tensile strength, bond strength, modulus of rupture, Elasticity, factors affecting modulus of elasticity, poisons ratio, creep, provisions of IS 456 in quality control

Durability: Significance of durability, mass transport in concrete, carbonation, chloride ingress Sulphate attack, freezing and thawing

IN-SITU TESTING AND SPECIAL CONCRETES:

Non–destructive testing; rebound hammer, ultrasonic pulse velocity, penetration and pull out test, principle, applications and limitations, core extraction

Special concretes; Introduction to fibre reinforced concrete, high strength concrete, self-compacting concrete, geo polymer concrete and ready mix concrete,

TEXT BOOK:

- Properties of Concrete - A M Neville (Pearson Education Asia Pvt ltd,), Four Edition

REFERENCE BOOKS:

- Concrete –microstructure,properties and materials –PK Mehta and paulo JM Monteiro (ICI)
- Concrete Technology - A R Santhakumar (Oxford –New Delhi)
- Concrete Technology - Gambhir ML(Tata McGrawHill)
- Concrete Mix Design - N Krishna raju
- Concrete Technology Theory and Practice - MS Shetty(S Chand and company)
- Relevant codes
- Current literature

EXPERIMENTS/ EXERCISES

Tests on Fine Aggregate:

1. Specific Gravity Test
2. Sieve analysis
3. Bulking of fine aggregate
4. Unit weight % Voids

Tests on Coarse Aggregate:

1. Specific Gravity & Water absorption test
2. Sieve analysis
3. Unit weight

Tests on Cement:

1. Consistency test on cement
2. Setting time test on cermet
3. Specific gravity test
4. Fineness of cement
5. Compressive strength of cement

Tests on fresh concrete:

1. Slump test
2. Compaction factor test
3. Vee-Bee Consistometer test
4. Flow table test

Tests on hardened concrete

1. Compressive strength of concrete cube
2. Compressive strength of Cylinder
3. Split tensile strength
4. Flexural strength of concrete beam

NDT tests

1. Pulse ultrasonic test
2. Rebound Hammer test.

Course Name	**Advanced Surveying**	Course Code	**15CV4DCASY**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:0:1:0**	**3Hours**	**50+50**

OBJECTIVES:

To enable the students to gain knowledge in the advancements of Surveying, which enables the student in a faster decision making process

COURSE OUTCOMES:

CO1: Apply fundamental principles and procedures for curve setting.

CO2: Recognize the characteristics of Triangulation.

CO3: Describe the functional components of field astronomy.

CO4: Recognize the basics of Photogrammetry Remote sensing and GIS

CURVE SETTING:

Simple Circular Curves, Elements, Setting out two theodolite method; Compound and Reverse curve, Elements, Relationship between various parts of reverse curve; Transition curve, elements, computation and setting out; Vertical curves computation and setting out.

6 Hours

TRIANGULATION:

Geodesic Surveying, Classification, Signals and towers, Base line masurement, Computations.

4 Hours

FIELD ASTRONOMY:

Definitions, Co-ordinate system, Astronomical triangle, Units of time, Determination of co-ordinates, Observations for time, Determination of Azimuth, Determination of Latitude and Longitude.

4 Hours

PHOTOGRAMMETRY:

Introduction – Basic Principles- Photo theodolites - Definitions – Horizontal and Vertical angle from teerestial photography – Horizontal position of a point from photo graphicmeasurement from camera horizontal axis - Elevation of point by photographic measurement – Focal length, Basics of Aerial Surveying.

4 Hours

REMOTE SENSING:

Introduction – Historical sketch of Remote Sensing - Idealized remote sensing – Basic principles of remote sensing – Electromagnetic energy electromagnetic spectrum – Wave length regions and their application in remote sensing – characteristics of solar radiation – Basic radiation law – EM radiation and atmosphere –Interaction of EM radiation with earth surface –remote sensing observation platform – sensors – applications.

4 Hours

GEOGRAPHIC INFORMATION SYSTEMS (GIS):

Definitions: The four M's concept – contributing disciplines for GIS, GIS objectives – components of a GIS –Topology –Data structures –Data base management –Errors in GIS –GIS software package – Linkage of GIS to remote sensing –application areas of GIS and Remote sensing; GIS concepts and spatial models; Spatial information, temporal information, conceptual models of spatial information, representation of geographic information, Data management.

4 Hours

TEXT BOOKS:

1. Kavanagh, Barry F. Surveying: Principles and Applications, Vol-2, 8^{th} Edition, 2009, Prentice Hall.
2. Remote Sensing and Image Interpretation – Lille Sand, John Wiley and Sons, 7^{th} Edition, 2015
3. Elements of Photogrammetry – Paul R Wolf, McGraw International, 4^{th} Edition, 2014

REFERENCES BOOKS:

1. Principles of GIS –Peter A Burrough, Oxford Publications
2. GIS and Computer Cartography –Christopher Jones, Longman Publications
3. GIS –Bemhardsen, Wiley Publications.
4. Surveying- Vol. II – B.C. Punmia, Ashok K. Jain, Laxmi Publications.
5. Remote Sensing and GIS – M Anji Reddy.
6. Arthur Bannister, Stanley Raymond and Raymond Baker. Surveying, Vol.2, 7^{th} Edition, Pearson Education.

EXPERIMENTS/EXERCISES:

1. Setting out a Simple Curve.
2. Setting out a Compound curve.
3. Setting out a Reverse Curve.
4. Setting out a Transition curve.
5. Setting out Bernoulli's lemniscate curve.
6. Triangulation: Baseline measurement.
7. Tracing contours.
8. Satellite stations reduction to centre.
9. GPS Survey.
10. Field Astronomy: Determination of latitude and longitude.
11. Remote Sensing: Digitization of an image.
12. GIS – Basics of data storage.

DEPARTMENT OF CIVIL ENGINEERING

Course Name	**Soil Mechanics**	Course Code	**15CV4DCSME**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:1:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To provide the basic principles and to understand the engineering behaviour of soil to address practical problems in soil mechanics.

COURSE OUTCOME:

CO1: Evaluate index properties of soils, analyze and interpret the experimental data to classify and identify soil.

CO2: Describe structure of soils, soil water systems and evaluate effective stresses in soils.

CO3: Explain the concepts and evaluate permeability, compaction characteristics and shear parameters of soil.

INTRODUCTION:

Definition, origin and formation of soil. Agents causing formation of soils. List of different soil types. Definition of mass, weight. Relation between mass and weight. Units of mass and weight in SI units. Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their interrelationships , Numerical problems

8 Hours

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION:

Index Properties of soils and their significance. Various index properties and their Laboratory determination, -Water content, Specific Gravity, Particle size distribution (Sieve analysis and Hydrometer analysis), Relative density, Consistency limits and their indices, in-situ density, Activity of Clay, Thixotropy of clay, IS classification; - Plasticity chart and its importance, Field identification of soils. Numerical problems

10 Hours

CLAY MINERALOGY AND SOIL STRUCTURE:

Single grained honey-combed, flocculent and dispersed structures, Types of soil-Water, base-exchange capacity, Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

Effective Stress: Effective stress concept-Total pressure and Porepressure, effect of water table, Numerical problems

6 Hours

FLOW OF WATER THROUGH SOILS-I:

Darcy's law- Assumption and validity, coefficient of permeability and its Laboratory determination, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, Numerical problems

Compaction of soils: Definition, Principle of compaction. Standard and Modified Proctor's tests and their compactive energy. Factors affecting compaction, Field compaction control, Numerical problems

8 Hours

SHEAR STRENGTH OF SOILS:

Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, factors affecting shear strength of soils, conventional failure envelope. Total and effective shear strength parameters, Sensitivity of clay. Measurement of shear parameters-Direct shear test, unconfined compression test, and, Tri-axial shear test., Types of drainage conditions,

8 Hours

TEXT BOOKS

1. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi,

REFERENCE BOOKS:

1. Punmia B.C. (2005), "Soil Mechanics and Foundation Engg.", 16th Edition, Laxmi Publications Co. , New Delhi.
2. Head K.H., (1986), "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London.
3. Braja, M. Das (2002), "Principles of Geotechnical Engineering", Fifth Edition, Thomson Asia Pte Ltd.,

4. Craig R.F. (2004), “Soil Mechanics”, 7th edition, Spon press, New York.
5. GopalRanjan and Rao A.S.R. (2000), “Basic and Applied Soil Mechanics”, New Age International (P) Ltd., New Delhi.
6. Lambe and Whitman (1979), “Soil Mechanics” John Wiley & Sons, New York
7. Terzaghi. K., and Peck. R.B. (1967) “Soil mechanics in Engineering practice”, 2nd Edition, John Wiley and Sons, New York.
8. Relevant B.I.S codes

E-BOOKS

1. http://www.myopencourses.com/subject/e-book-on-concepts-and-techniques-in-geotechnical-and-foundation-engineering
2. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm
3. nptel.ac.in/courses/105101084/
4. https://ay14-15.moodle.wisc.edu/prod/course/view.php?id=499

Course Name	**Hydraulics & Hydraulics Mechanics**	Course Code	**15CV4DCHYM**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:0:1:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable the students to gain knowledge in understanding the fundamentals of hydraulics and functioning of hydraulic machine. Expose the students to experimental techniques in hydraulics and evaluations of hydraulic machines.

COURSE OUTCOME:

CO1: Understand and analyse the Uniform & Non Uniform Flows in open channels.

CO2: Understand Impulse Momentum Equation and its applications & carry out computations on impact of jet on fixed, moving plates.

CO3: Understand the working of pumps and turbines and study the performance of these machines.

CO4: Understand the dimensional analysis and apply it in the design of prototypes.

FLOW IN OPEN CHANNELS: Definition of channel, difference between pipe and open channel flow, classification, types of flows, geometric properties of open channels.

2 Hours

Uniform flow in open channels, Chezy's & Manning's formula, Most economical open sections- rectangular, trapezoidal, circular sections- derivations. Specific Energy, definitions, Specific Energy curve, condition for Maximum discharge & Minimum specific energy, critical flow in rectangular sections.

4 Hours

FLOW IN OPEN CHANNELS (NON-UNIFORM FLOW): Definition, Types of Non- Uniform flows, Gradually Varied flow- derivation & Problems, Classification of channel bottom slopes, hydraulic jump, hydraulic jump in a rectangular channel, types & applications.

5 Hours

IMPACT OF JET ON VANES: Introduction to impulse momentum equation, Force exerted by a jet of water on fixed and moving plates- Vertical, inclined, symmetrical and unsymmetrical curved plates, series of curved vanes, velocity triangles, work done & efficiency

5 Hours

TURBINES: Definition, classification, Pelton turbine, theory, equation for work done and efficiency, problems, Francis turbine, Kaplan turbine, theory, equation for work done and efficiency, Specific speed, unit quantities, characteristic curves.

5 Hours

PUMPS: Definition, classification general principle, priming, work done, minimum starting speed

5 Hours

TEXT BOOKS:

1. Hydraulics & Fluid Mechanics – P.N. Modi & S.M. Seth, Standard Book House, New Delhi, 20th Edition, 2015

REFERENCE BOOKS:

1. Experimental Fluid Mechanics - Asawa,G.L., Vol.1, Nem Chand and Bros.,
2. Flow through Open Channels , Subramanya K, TMH Publications
3. Fluid Mechanics- R.K. Bansal, Laxmi Publications, New Delhi.
4. Fluid Mechanics- K.L. Kumar, S. Chand & Company Ltd, New Delhi.
5. Fluid Mechanics through Problems- Garde,R.J., New Age International Publications, New Delhi.
6. Flow through open channels- Ranga Raju, K.G., T.M.H. 2nd edition
7. Open Channel Hydraulics- V.T. Chow, Mc-Graw Hill Publications.

E-Books

http://nptel.ac.in/courses/105103096

http://nptel.ac.in/courses/105107059/

http://elearning.vtu.ac.in/P6/enotes/CV44/Flw_OpenCh-NB.pdf

EXPERIMENTS/EXERCISES:

1. Hydrostatic Bench
2. Reynold's Apparatus
3. Heale Shaw Apparatus
4. Pressure drop in a Venturi meter
5. Friction in pipes
6. Coefficient of discharge of an Orifice & Mouth Piece

7. Coefficient of discharge of a V- Notch
8. Coefficient of discharge of an oghee weir & a Rectangular notch
9. Coefficient of discharge of a Venturimeter
10. Study the impact of jets on vanes
11. Study on hydraulic jump
12. Centrifugal pump and turbines

Course Name	**Building Planning & Drawing**	Course Code	**15CV4DCBPD**	SEE Duration	SEE+CIE
Credits	**04**	L-T-P-S	**1:0:1:2**	**4 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:

CO1: Prepare drawings of components of a building.

CO2: Design and prepare functional drawings for buildings as per norms.

CO3: Develop drawings showing the interconnectivity of functional components of buildings along with service layouts.

Guidelines for building drawings, Scales, definition of terms used in building drawings. To prepare geometrical drawing of component of buildings i) Stepped wall footing and isolated RCC column footing, ii) RCC dog legged stairs, iii) Doors & windows (Fully paneled door & glazed window), iv) Truss (Wooden & steel)

15 Hours

Specification for residential and public building, bye laws, setback distances and calculation of carpet area, plinth area and floor area ratio.

Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram of public buildings (Primary Health Centre, office building, school building).

12 Hours

For a given single line diagram, preparation of water supply, sanitary and electrical layouts,

6 Hours

Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings, i) Two bed room single storey building, ii) Two storeyed building (Only for Practice)

15 Hours

Text Books:

1. **“Building Drawing”**, by Shah M. H. And Kale C. M., Tata McGraw Hill Publishing Co. 2002

REFERENCE BOOKS:

2. **“A Course in Civil Engineering Drawing”**, by V. B. Sikka, S. K.Kataria & Sons.
3. **“Building Construction”**, Gurucharan Sing, Standard publication
4. **IS:962-** Code of practice for architecture and building drawing National Building code, BIS, New Delhi

V SEMESTER

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 ≤ 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 ≤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 ≤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/-**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.
5
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. 0**2 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
0**5 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 0**5**
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. 0**6Hours**

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", 4th 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 2nd edition, New Age International (P) Ltd., New Delhi.
5. Head K.H., (2006), "Manual of Soil Laboratory Testing", 3rd 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", 3rd Edition, Wiley India Pvt Ltd, New Delhi.
8. Relevant B.I.S codes, ASTM and BS codes.

E Learning resources:

1)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

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

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.

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, Constitute 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

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

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 –

8 HOURS

Pollution control for specific major industries, Numerical problems.

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

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

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 manmade; 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
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 sahni, Alka Dhameja, Uma Medury, “Disaster mitigation experiences and reflection”, PHI

GLOBAL WARMING AND CLIMATE CHANGE

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

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 Charcterestics 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 Clmate change : Change of Temperature in the environmen-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.

VI SEMESTER

VI SEMESTER CIVIL ENGINEERING
Design of Steel Structures

Course Name	Design of steel structures	Course Code	16CV6DCDSS	SEE Duration	SEE+CIE
Credits	04	L-T-P-S Credits	3:1:0:0	03 Hours	50+50

Course Objective:

To teach the students, the method of design of various steel structural members and their connections.

Course Outcome:

CO1.: Knowledge of limit state design and its techniques.
CO2: An ability to analyse and design structural steel joints.
CO3 : An ability to analyse and design structural steel members subjected to flexure, tension and compression.
CO4: An ability to understand the concepts of plastic analysis and use for the design of structural elements.

Introduction: Advantages and disadvantages of steel structures, Loads and load combinations, Design considerations, Limit state method (LSM) of design, Failure criterion of steel, codes, Specifications and section classification. **04Hours**

Design of Tension Members: Introduction, Types of tension members, Slenderness ratio, Behavior of axially loaded tension members, Modes of failure, Factors affecting the strength of tension members, Design of axially loaded tension members with bolted and welded connection, Lug angles. **06Hours**

Design of Compression Members: Introduction, Behavior of compression members, Sections used for compression members, built up sections, Effective length of compression members, Design of compression members with lacing, Design of simple slab base and gusseted base. **12Hours**

Design of beams: Introduction, Beam sections, factors affecting lateral stability, Behavior of simple rolled steel beams in bending, Design of laterally supported and laterally unsupported rolled steel beams.
Design of Plate Girders: Basic design of plate girders using tension field method (Economical depth, Stiffeners only) **10hours**

Bolted Connections: Introduction, Behavior of bolted joints, Design of Simple joints with ordinary black bolts and High strength Friction Grip Bolts(HSFG), Moment resistant connections(moment parallel and perpendicular to the plane of joint),beam to beam and beam to column connection (framed connection only) **08Hours**

Welded Connections: Introduction, Welding process, Advantages of welding, Types and properties of welds, Types of joints, weld symbols, Weld specifications, Effective areas of welds, Design of welds, Design of Simple joints, Moment resistant connections(moment parallel and perpendicular to the plane of joint),beam to beam and beam to column connection (framed connection only) **06 Hours**

Plastic Behavior Structural Steel: Introduction, plastic theory, Plastic hinge concept, plastic collapse load, conditions of plastic analysis, Theorems of plastic collapse, Plastic analysis of Continuous Beams (No design) **06 Hours**

Note: Study of this course shall be based on IS 800-2007

Text Books:

1. Design of steel structures-N Subramanian,Oxford publishers, Published: 2011
2. Limit state design of steel structures-Duggal,Tata- Mcgraw Hill Publishers, 2nd Edition

Reference Books:

1. Limit state design of steel structures (Based on IS-800-2007 in SI Units)-Dr.Ramchandra and Virendra Gehlot,Scientific Publishers
2. Design of steel structures by Limit state method-S.S.Bhavikatti,I.K.International publishers.
3. Steel structures-Design and practice by N. Subramanian, oxford university press

VI SEMESTER CIVIL ENGINEERING
Design of RC Structures

Course Name	Design of RC structures	Course Code	16CV6DCDRC	SEE Duration	SEE+CIE
Credits	04	L-T-P-S Credits	3:1:0:0	03 Hours	50+50

COURSE OBJECTIVE:
To provide fundamental knowledge of concrete and steel reinforcement used for reinforced concrete design, and knowledge of design methodologies for different load conditions.

COURSE OUTCOME:

CO1: Explain the fundamental principles and procedures in the component design of reinforced structures.

CO2: Apply the principles of analysis of the Indian code design specification, the concepts of strain compatibility and equilibrium concepts to determine the strength of RC members.

CO3: Design of simple RC components as per IS Codes.

Objectives and Methods of Analysis and Design, and Properties of Concrete and Steel: Introduction, Objectives of the Design of Reinforced Concrete Structures, Method of Design, Analysis of Structures, Design Loads, Loads and Forces, Properties of Concrete. Workability and Durability of Concrete, Properties of Steel.

Philosophies of Design by Limit State Method: Introduction, Basic principles of working stress method, Principles of limit state method, Partial safety factors, Characteristic and design loads, Characteristic and design strength, Stress block parameters for limit state of collapse by flexure Ultimate flexural strength of singly reinforced rectangular sections, Doubly reinforced rectangular sections, flanged sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage. Analysis examples of singly reinforced, Doubly reinforced, flanged sections, Shear strength and development length

Serviceability limit states: General aspects of serviceability, Deflection limit as in IS: code, Calculation of deflection (Theoretical method) Cracking in structural concrete members, Calculation of deflections and crack width.

Design of Beams: General Specification for flexural design of beams-Practical requirements, Size of beam, Cover to reinforcement, Spacing of bars, Design procedures for critical sections for bending moment and shear, Anchorages of bars, Check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Design examples for simply supported and Cantilever beams for rectangular and Flanged sections.

Design of Slabs: General consideration of design of slabs, Rectangular slabs spanning one direction Rectangular slabs spanning in two directions for various boundary conditions. Design of simply supported, cantilever and continuous slabs.

Design of Columns: General aspects, Classifications Effective length of column, Loads on columns, Slenderness ratio for columns, Minimum eccentricity, Design of short axially loaded columns, Design of column subject to combined axial load and uni-axial moment Biaxial moment using SP – 16 charts.

Design of Footings: Introduction, load for footings. Design basis for limit state method, Design of isolated rectangular footing for axial load and uniaxial moment.

Design of Stair cases: General feature, Types of stair case, loads on stair cases, effective span as per IS code provisions, Distribution of loading on stairs, Design of Open Well & Dog Legged Stair case.

TEXT BOOKS

1. Limit State design of reinforced concrete by PC Verghese, PHI-Learning Pvt. Ltd, New Delhi, 2nd edition (2012)

2. Reinforced Concrete Design – S. Unnikrishnan Pillai and Devadas Menon, tata McGraw-Hill Publishing Company Limited, New Delhi., 3rd edition 2009

REFERENCE BOOKS

1.Limit State design of reinforced concrete – BC Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Publications, New Delhi

2 Reinforced concrete structures - Park and Paulay- John Wiley and sons, Singapore

3. Limit state design of reinforced concrete structures – P Dayaratnam, Oxford and IBH

Publishing company Pvt ltd., New Delhi

4. Design of Reinforced concrete structures – N. Krishna Raju, CBS Publishers, New Delhi

WASTE WATER TREATMENT

Subject	Waste Water Treatment	Sub. Code	16CV6DCWWT	SEE Duration	SEE+CIE
Credits	05	L-T-P-S Credits	2:0:1:2	3 Hrs	50 + 50

COURSE OBJECTIVE:

To provide knowledge about waste water characteristics, their disposal, treatment methods and to design sewers

COURSE OUTCOME:

CO1: Describe strength of waste water and select appropriate treatment and disposal methods

CO2: Explain the concepts of sewage systems and design sewers

CO3: Describe and design various components of waste water treatment facilities

Introduction: Necessity for sanitation, methods of domestic waste water disposal, types of sewage systems and their suitability.

Design of Sewers: Hydraulic formulae for velocity, effects of flow variations on velocity, self-cleansing and non-scouring velocities, design of hydraulic elements for circular sewers flowing full and flowing partially full. (No derivations) **07 Hours**

Materials of Sewers: Sewer materials, shapes of sewers, laying of sewers, joints & testing of sewers, ventilation & cleaning of sewers. **04 Hours**

Sewer Appurtenances: Catch basins, manholes, flushing tanks, oil and grease traps, drainage traps. Basic principles of house drainage. Typical layout plan showing house drainage connections, maintenance of house drainage. **05 Hours**

Waste Water Characteristics: Sampling, significance, techniques and frequency. Physical, chemical and biological characteristics, Aerobic and anaerobic activity, CNS cycles. BOD and COD. Their significance problems. 0**5 Hours**

Disposal of Effluents: Disposal of effluents by dilution, self-purification phenomenon. Oxygen sag curve, Zones of purification, sewage farming sewage sickness, effluent disposal standards for land, surface water & ocean. Numerical problems on disposal of effluents. Streeter Phelps equation. **04 Hours**

Treatment of Waste Water: Flow diagram of municipal waste water treatment plant. Preliminary & primary treatment: Screening, grit chambers, skimming tanks, and primary sedimentation tanks – design criteria & design examples.
05 Hours

Secondary Treatment Suspended growth and fixed film bioprocess.
Tricking filter–theory and operation, types and designs. Activated sludge process – principle and flow diagram, modifications of ASP, F/M ratio. Design of ASP **05 Hours**

Low cost treatment methods: Septic tank, oxidation pond and oxidation ditches–design. Reuse and recycle of waste water**.** **04 Hours**

Site visit to sewage Treatment plant

Text Books:

1. Sewage disposal and air pollution engineering. S.K.Garg,Khanna publishers, 2015
2. Sewage disposal and engineering. B.C.Punmia.Arihant publications, 2016

Reference Books:

1. Water and waste water engineering vol-II: Fair, Geyer and Okun: John Willey Publishers, New York.
2. Waste water treatment, disposal and reuse: Metcalf and Eddy Inc: Tata McGraw Hill Publications.
3. Manual on waste water treatment: CPHEEO, ministry of urban development, Delhi.

VI SEM CIVIL ENGINEERING

EXTENSIVE SURVEY PROJECT

Sub Code	**16CV6DCESP**	**Total Hrs**	**Field Hours+ 39 Hours**	**L:T:P: S = 1:0:1:2 Credits**
Credits	**4**	**Exam Marks**	**CIE+SEE=50+50**	**Contact hours 3 hrs**

The extensive survey project shall be conducted at a suitable site for a period of one week, where possible arrangement shall be made for all the students and teacher to camp near the project site.

Field data shall be collected using modern surveying tools such as total station, auto levels etc. Students shall be encouraged to down load and process the data each day.

Project could be chosen from the following set.

Projects:

- Housing and town planning
- Hydraulics & Irrigation
- Roads and Bridges
- Water Supply and Sanitation
- Public health
- Infrastructure related projects.
-

Proposed Evaluation: Students are expected to prepare a detailed report giving the introduction, projects details and design for a final viva-voce examination.

VI SEM CIVIL ENGINEERING

SOFTWARE APPLICATION IN CIVIL ENGINEERING

Sub Code	16CV6DCSWL	Total Hrs	26 Hours	SEE Duration	L:T:P credits
Credits	2	Exam Marks	CIE+SEE=50+50	2 hrs	1:0:1

Course outcome:

1. An ability to understand Computational techniques related to civil engineering structural elements.
2. An ability to analyse and design RCC and steel structures using the software tools
3. An ability to model Civil Engineering structural elements using the software tools to understand their behavior

1. Analysis of structural elements such as Beam, column, slab, footing for a given loading and boundary conditions

2. Design of structural members such as Beam, column, slab, footing for given loading and boundary conditions

3. Analysis and design of rolled steel roof trusses

4. To analyse and design a RCC/Steel frame completely

5. FEM modeling of simple structural elements (Beams, columns slabs, trusses, frames, masonry elements, soil behavior etc.,) for different loading and end conditions, to evaluate the load versus deflection diagrams etc.,

MS EXCEL

6. Calculation of areas and volumes for the given data
7. Plotting of different types of graphs for the given data

References:

Training manuals and User manuals

VI SEM CIVIL ENGINEERING
ELECTIVE: THEORY OF ELASTICITY

Course	Theory of Elasticity	Sub. Code	16CV6DETOE	SEE Duration	SEE+CIE
Credits	3	L-T-P-S Credits	3:0::0:0	3 Hrs	50 + 50

Course Objectives:

- Introduce continuum mechanics to students and prepare them to take Finite Element Analysis
- **Course outcome**:

An ability to

CO1: Explain the concepts of stress invariants and strains transformations,

CO2: Discuss stress-strain relations and Torsion of Circular and non-circular sections

1. Concepts of stress at a point and stress tensors, Transformation of stresses, Stress Invariants - Principal stresses, Maximum Shear stresses and their planes (3D problems), Octahedral stress, Hydrostatic state of stress, Equilibrium equations.
2. Concepts of strain at a point and strain tensor, Engineering strain, Transformation of strains, Principal strains, Maximum strains and their planes, Compatibility equations.
3. Constitutive Laws, Generalized Hooke's Law, Stress – Strain relations, Strain – Displacement relations, equilibrium and compatibility conditions in Cartesian and polar co-ordinates in two dimensions, Airy's stress function.
4. Torsion of circular sections, St.Venant's theory, membrane analogy**.**
5. Stress concentration due to circular holes in plates, effect of concentrated load in straight boundaries.

Text book:

1. Advanced Mechanics of Solids, 3rd edition, L S Srinath, McGraw Hill pub., 2009

Reference Books:

Theory of Elasticity - Timoshenko & Goodier - McGraw Hill
Elasticity tensor, Dyadic and Engineering applications- Chow P.C. & Pagano N.J - D.Von Nastrand
Theory of Elasticity- Sadhu Singh- Khanna Publishers
Theory of Elasticity - Verma P.D.S - Vikas Publishing Pvt. Ltd
Plasticity for Structural Engineers- Chenn W.P and Hendry D.J- Springer Verlag
Continuum Mechanics Fundamentals- Valliappan C.- Oxford IBH Publishing Co. Ltd.,
Applied Stress Analysis- Sadhu Singh- Khanna Publishers
Engineering Solid Mechanics - Abdel Rahman Ragab, Salah E A Bayoumi- CRC press, London
Applied Elasticity- Sitharam T G and Govindaraju- Interline publishing
Advanced Mechanics of Materials- Seely and Smith- John Wiley

VII SEMESTER

Course Name	**REMOTE SENSING AND GIS**	**Course Code**	**16CV7IERSG**	**SEE Duration**	SEE+ CIE
Credits	03	**L:T:P:S**	3:0:0	**3 hours**	**50+50**

COURSE OBJECTIVES

To introduce remote sensing and GIS as a Vital tool for faster decision making. The main aim of the course is to impart knowledge on the concepts and application of remote sensing and GIS for general and specific tasks.

COURSE OUTCOMES

An Ability to

CO1: Explain the principles of Geodatabase

CO2: Discuss the application of multicriteria decision analysis for various issues.

CO3: Recognize the various advances in GIS

CO4: Outline the applications of enterprise and expert GIS

UNIT I

Geodatabase: Types of geodatabase, Advantages of geodatabase, Basic geodatabase structure, Topology, Relational classes, geometric networks, raster data - Creating geodatabase, organizing data, defining databaseStructure - Understanding spatial reference in geodatabase - Modifying spatial domain, Simple feature creationingeodatabase, Creating and editing map topology, Types of geodatabase annotation - Adding behavior to a Geodatabase **6 hrs**

UNIT II

Multi-Criteria Decision Analysis and SDSS: Elements of multi-criteria decision analysis, classification of decision problems, evaluation criteria, hierarchical decision alternatives and constraints, alternatives anddecision variables, deterministic variables, criteria weighting , estimation weights, ranking methods, decisionrules, multi-attribute decision rules, sensitivity analysis, multi-criteria spatial decision support systems (SDSS).

SDSS for location planning, application-specific capabilities; requirements of a SDSS.
8 hrs

UNIT III

Advanced GIS

Introduction to Geographic Resources Analysis Support System (GRASS) GIS Raster data handling Reclassification, recode map algebra Resampling and interpolation of raster data. Overlaying Spatial analysis Neighborhood analysis and cross-category statistics -buffering Cost surfaces --Terrain and watershed analysis –Modeling raster data-Vector data handling-Topological operations -Buffering –Overlay –Dissolve –clip, union intersect –Network analysis–Spatial interpolation–handling lidar point cloud data.
8 hrs

UNIT IV

Expert GIS: Introduction to concepts of Expert GIS, Data formats, Proprietary file formats, translator and Transfer formats, open formats, standards, metadata, standards gazetteer, XML and GML, Spatial databases, Relational databases, object databases, GIS and databases, advanced database technology, derived mapping –

Generalization, text placement, automated cartography, data from imagery, Web GIS, simple maps in webpages, internet mapping sites, internet softwares, Mobile GIS – positioning, location based services, personal and Vehicle navigation, LBS for mass market, telematics. –Applications **6 hrs**

UNIT V

Enterprise GIS: User need assessment; old and new spatial database models, SDE layers, Geo database, Architecture design, capacity planning (Hardware), security planning, RDBMS software selection, GIS software selection, planning for migration. Enterprise GIS management. **6hrs**

UNIT VI

Case Studies: GIS analysis in transportation, GIS analysis in water management, urban development, environmental analysis, hydrological modeling, Habitat suitability modeling, virtual cities 3D modeling and visual simulation, Automata based models of Urban system, Other applications. **6hrs**

TEXT BOOKS

1.GIS and Multi-criteria decision analysis by Jacek Malczewski, John Wiley and sons.2015

2.Concepts and Techniques of Geographic Information Systems CP Lo Albert K W Yeung, 2015 Prentice Hall of India.

3.Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc,New York, 2014.

REFERENCE BOOKS

1.Remote sensing and Image interpretation by Thomas M. Lillesand and Ralph W. Kiefer, JohnWiley and Sons Inc., New York, 2014

2.Geographical Information Systems – Principles and Applications, Volume I edited by David J.

Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 2014

3.Geographical Information Systems – Principles and Applications, Volume II edited by David J.

Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons.Inc., New York 2014.

.nptel.ac.in/courses/105102015/50

. www.gistutor.com › ESRI ArcGIS

Course	Finite Element Method Of Analysis	Course Code	16CV7IEFEA	SEE Duration
Credit	03	L-T-P	3:0:0	3hrs
Total Hrs	39 Hrs	SEE+CIE	50+50	

Course Objectives:

The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues associated with solids and structures.

Course Outcomes: At the end of the course, the student will be able to:

CO1 **APPLY** basics of Theory of Elasticity to continuum problems.
CO2 **FORMULATE** finite element like bar, truss and beam elements for linear static structural analysis.
CO3 **DEVELOP** finite element models for 2D elements.
CO4 **COMPUTE** Mass matrices for bar and beam elements.
CO5 **SOLVE** problems of limited complexity in Linear static and Dynamics of structures.
CO6 **UTILIZE** finite element software to simulate practical problems.

UNIT -1

Fundamental concepts: Principles of Elasticity: Concept of stress – Stress at a point – equilibrium equations. Strain displacement relationships in matrix form – Constitutive relationships for plane stress and plane strain. 03 Hrs

Introduction to Finite element method (FEM), Basic concept, Historical background, Engineering applications, Classification of elements, Banded matrix and node numbering, Steps for solving problems using FEM. Commercial packages – Preprocessor, Solver and Post processor. 02 Hrs

Approximate method of structural analysis – Rayleigh-Ritz method, Galerkin's method, Finite element method, etc. Rayleigh-Ritz method applied to simple axially loaded members and beam. 04Hrs

UNIT - 2

One dimensional problems: Finite Element Modeling using two noded bar element–Definition of generalized coordinates and identification of degrees of freedom. Polynomial based interpolation model, Convergence criteria, Shape functions, Stiffness matrix by minimum potential energy principle, Properties of stiffness matrix, Global stiffness matrix, Consistent load vectors for traction and body force and Temperature effects. Numerical problems on simple bars subjected to forces and temperature change for displacements, reactions and stresses. 06 Hrs

UNIT - 3

Analysis of Trusses and beams: Formulation of stiffness matrix for trusses. Hermite shape functions, Formulation of stiffness matrices for beams, Consistent load vectors for uniformly distributed load and triangular load. Numerical examples on beams and Trusses. 06 Hrs

UNIT - 4

Two dimensional problems: Nodal displacement parameters, PASCAL's triangle – geometric isotropy. Shape functions in Cartesian and Natural coordinates for three noded triangular (CST) and four noded quadrilateral elements. Concept of isoparametric elements, Development of strain-displacement matrix and stiffness matrix, Jacobian matrix, consistent nodal load vector. 07Hrs

Sub-parametric and Super-parametric elements and Numerical integration using gauss quadrature approach. Higher order elements – Serendipity and Lagrangian family of Finite elements. 04Hrs

UNIT - 5

Structural dynamics: Steps in FEM applied to problems in Structural dynamics – Consistent and lumped mass matrices – evaluation of Eigen values and Eigen vectors for simple bars and beams. 07 Hrs

TEXT BOOKS

1. Krishnamoorthy C.S., "Finite Element Analysis", 2nd ed., Tata-McGraw-Hill Education Pvt. Ltd., 2004.
2. Desai.Y.M.,Eldho.T.I., and Shah. A.H., "Finite Element Method with Applications in Engineering", Pearson publication, 2011.

REFERENCE BOOKS

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", 2nd ed., Prentice Hall, India, 2003.
2. Zienkiewicz O.C., "The Finite Element Method – Basic & Fundamentals", 7th ed., Book-Aid International, 2013.
3. Reddy J.N., "An Introduction to the Finite Element Method", 3rd ed., McGraw-Hill, 2005.
4. Cook R.D., "Concepts and Applications of Finite Element Analysis", 4th ed., John Wiley & Sons, 2004.
5. Rajashekaran S., "Finite Element Analysis in Engineering Design", Wheeler Publishing, 2006.
6. Logan D.L., "First Course in the Finite Element Method", 4th ed., Cengage Learning, 2007.
7. Hughes T.J.R., The Finite Element Method: Linear Static and Dynamic Finite Element Analysis", 1st ed., Dover Publications, 2000

E-Books / Web References

http://nptel.ac.in/courses/112104115/

MOOCs

1. Finite Element Method (FEM) Analysis and Applications https://www.edx.org/course/finite-element-method-fem-analysis-tsinghuax-70120073x
2. A Hands-on Introduction to Engineering Simulations https://www.edx.org/course/hands-introduction-engineering-cornellx-engr2000x

Alternate assessment tool (AAT) for CIE: Utilization of finite element software to simulate practical problems – ABAQUS/ANSYS.

Scheme of Examination: Answer any **Five** full questions out of **seven** questions.**Note:** At least one question from each units.

Course Name	Design and Drawing of RCC and Steel Structures	Course Code	16CV7DCDDG	SEE Duration	SEE+CIE
Credits	4	L-T-P-S	2:0:2:0	4 Hours	50+50

Course Objective:

To provide knowledge of design and detailing of RCC and Steel Structural components

Course Outcomes:

An ability to:

CO1: Design and prepare working drawings of RCC Structural components

CO2: Design and prepare working drawings of Steel Structural components

PART A: RCC Structures

Given data **-**Drafting only

1. Beam slab floor system consisting of one way and two-way slabs and continuous beam (1- Sheet) **6 Hrs**

Design and Drawing

2. Square, Rectangular and Circular water tanks (3 – Sheets) **8 Hrs**
   (2-Isolated Column & footing with eccentricity & rectangular combined footing(2 Sheets) **8 Hrs**
3. Cantilever and counterfort retaining walls (2 – Sheets) **8Hrs**

PART B: Steel Structures

Given data-Drafting only

1. Beam to Beam and Beam to column (framed and seated), Bolted and welded connections. (2- Sheets) **6Hrs**

Design and Drawing

2.Column and column bases (slab base & gusseted base) (2- Sheets) **8 Hrs**

3.Simple and Built up beams and welded plate girder (1- Sheet) **8 Hrs**

TEXT BOOKS

1. N. Krishnaraju, Structural Design & Drawing Reinforced Concrete & Steel, University Press.
2. S. Krishnamoorthy, Structural Design and Drawing (Concrete Structures), CBS publishers, New Delhi. Tata McGraw publishers.
3. N. Subramanian, Design of Steel Structures, Oxford University, Press.

REFERENCE BOOKS:

9. IS: 456-2000, IS: 800–2007, SP-16, SP-34, SP 6 (1) – 1984 or Steel Table.
10. B.C. Punmia, Reinforced Concrete Structures,Laxmi Publishing Co.
11. S.N.Sinha, Reinforced Concrete Design, McGraw-Hill Education
12. Negi, Design of Steel Structures, Tata McGraw Hill Publishers.

Question paper pattern:

To answer question no. 1 or 2 completely.

Question no. 1 Part A: 70 marks, Part B – 30 marks.

Question no. 2 – Part B: 70 marks, Part A – 30 marks.

Course Name	Analysis and Design of PSC members	Course Code	16CV7DCPSC	SEE Duration	SEE+CIE
Credits	4	L:T:P:S	4:0:0:0	3 hours	50+50

Course Objectives

To understand the fundamental concept of pre-stressing and to analyze and design flexural members

Course outcome:

An ability to

1. Comprehend pre-stressing and its techniques.

2.Evaluate the nature of stresses in the flexural member.

3.Design the flexural member.

Introduction, Materials of pre stressing, Pre stressing systems

Basic concepts of pre stressing, historical development need for high strength of steel and concrete, terminology, advantages and applications. High strength concrete and high tensile steel Tensioning device, post tensioning systems, thermo electric pre stressing, chemical pre stressing. **7 hrs**

Analysis of PSC beams

Basic assumptions, analysis of pre-stress, resultant stresses at a section, pressure line or thrust line. Concept of load balancing, stresses in tendons, cracking moments **10 hrs**

Losses of pre stress, Deflection of pre-stressed concrete members

Nature of losses of pre stress, losses due to elastic deformation, loss due to shrinkage, creep, relaxation of stresses in steel, friction, anchorage slips, total losses allowed for design. Factors influencing the deflections, Importance of control of deflection. Short term and long term deflections. 0**8hrs**

Flexure and shear strength of pre stressed concrete sections

Types of flexural failure, strain compatibility, code procedures, Full and partial pre-stressed sections. Principal stresses, design of section for Flexure, ultimate shear resistances, design of shear reinforcements**.** **10hrs**

Transfer of pre-stress in PSC members

Transmission of pre stressing force by bond, transmission length, bond stresses, end zone reinforcement, flexural bond stresses as per code practice. **5hrs**

Anchorage zone stresses, Design of pre tensioned and post tensioned flexural members

Introduction, stress distribution in end block, investigation of anchorage zone stresses, anchorage reinforcement. Dimensioning of flexural members, estimation of self-weight of the beam, design of post and pre tensioned beams, design of partially pre stressed members**.** **12hrs**

Scheme of Question paper: The examiner has to set a total of six questions choosing one from each unit, which includes a compulsory question covering the entire syllabus, and the student has to answer five full questions.

Text Books

1)Pre stressed concrete by N.KrishnaRaju, 5thEdnTataMcgraw-Hill Publishing company limited

2)Pre stressed concrete by P.Dayaratnam,4thEdn, Oxford &IBH Publishers

References

1)Pre-stressed concrete, Analysis and Design Fundamentalsby Antoine Ewaaman, McGraw Hill Publishers

2)Pre-stressed concrete by S.K.Mallik&A.P.Gupta, Oxford & IBH Publishing Co.

3)Pre-stressed concrete bridges by V.N.Vazirani and S.P Chandola 3rded. Khanna Publishers, New Delhi

4)Pre-stressed concrete by G.S.Pandit&Gupta CBS Publishers, New Delhi

Course Name	Quantity Surveying and Costing	Course Code	16CV7DCQSC	SEE Duration	SEE+CIE
Credits	06	L-T-P-S	3:1:0:2	4 Hours	50+50

COURSE OBJECTIVES:

To provide basic knowledge of estimation and analyse the methods of estimation for various civil engineering works

COURSE OUTCOMES:

CO1: Estimate the material quantities of various Civil Engineering works

CO2: Apply Cost Estimate

CO3: Perform Rate analysis

CO4: Write specifications for various items

INTRODUCTION:

Estimation, types of estimation, approximate methods of estimation, Detailed methods of estimation, cost of materials and labour. **4Hrs**

ESTIMATION OF BUILDINGS:

Introduction, terms used in estimation, units of measurement, abstract. Methods of taking out quantities– center line method, long wall and short wall method. Preparation of detailed and abstract of estimates for the following Civil Engineering works – Masonry buildings with flat roofs. **RCC structural elements such as slabs, column, isolated footings and beams**. **15 Hrs**

ESTIMATION OF OTHER CIVIL WORKS:

Steel trusses, RCC slab culvert, manhole and septic tanks. **8 Hrs**

EARTHWORK ESTIMATION:

Methods of earthwork estimation. Estimation of earthwork of roads by mid sectional area method, mean sectional area method, trapezoidal and prismoidal formula methods.

8 Hrs

SPECIFICATIONS:

Introduction, Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of common item of works in buildings only. **8 Hrs**

ANALYSIS OF RATES: Definition. Working out quantities and rates for the following standard items of works – Earth work in different types of soils**, plain cement concrete of different mixes**, **brick and stone masonry, flooring**, plastering, RCC works.

12 Hrs

TEXT BOOK

1. Estimating and Costing in Civil Engineeringby B. N. Dutta, UBS Publishers and distributors Pvt. Ltd, New Delhi

REFERENCE BOOKS:

1. Quantity Surveying-P.L.Basin S. Chand: New Delhi.
2. Estimating & Specification - S.C. Rangwala:: Charotar publishing house, Anand.
3. Text book of Estimating & Costing- G.S. Birde, DhanpathRai and sons : New Delhi.
4. A text book on Estimating, Costing and Accounts- D.D. Kohli and R.C. Kohli S. Chand : New Delhi.

Course Name	Transportation Systems	Course Code	16CV7DCTRS	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3:0:0:0	3 Hours	50+50

COURSE OBJECTIVES:

To provide the basic knowledge of Transportation systems, Components of permanent way, types of rails and its components, Design of Rail Geometrics, to understand the Layout of an airport and its classification, Design of Runway and Taxiways and Introduction to harbor and tunnel engineering, to provide the basics of traffic engineering and introduction to intelligent transportation systems.

COURSE OUTCOMES:

CO1: Identify the components of permanent way and their required quantity of materials for construction.

CO2: Design the geometrics of a Railway Track.

CO3:Calculate the corrected runway length and taxiway geometrics.

CO4: Recognise the fundamentals of Harbour and Tunnel Engineering.

CO5: Explain the concepts of Traffic Engineering.

Introduction: Role of railways in transportation, Indian Railways, selection of routes.

02 Hours

Permanent way: Introduction, requirements for an ideal permanent way, typical cross sections of single and double line B.G. tracks – in cutting , embankment. Gauges and types of gauges with dimensions. Coning of wheels and tilting of rails. Problems on these. Rails functions requirements, types of rail sections.

04 Hours

Ballast and Sleepers: Functions, requirements, types, track fittings and fasteners, calculation of quantity of materials needed for laying a track.

Traction and tractive resistances, tractive power, Hauling capacity.Problems on above.
05 Hours

Geometric Design of Track – Necessity of Geometric Design of railway track, gradient and types of gradient. Speed of train, curve, transition curve, super elevation, cant-deficiency, negative cant- speed calculation based on Indian Railways Formulae for High speed tracks only-problems on above.
08 Hours

AIRPORT, TUNNELS & HARBOUR ENGINERING

Introduction: Introduction to airport engineering, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications - Site selection-Regional Planning. **03 Hours**

Runway Design- Orientation of runway by using wind rose diagram, the runway configurations- basic length of the runway –corrections to runway length by ICAO and FAA specification- runway cross sections- problems on above. **06 Hours**

Taxiway Design: Factors affecting the layout of the taxiway-geometrics of taxiway-design of Exit taxiways- ICAO Specifications. Problems on above. **03 Hours**

Tunnels: Introduction – types of tunnels, advantages and disadvantages. **02 Hours**

Harbours: Introductions, classifications, natural phenomenon affecting the design of harbour viz. wind, wave, tide and currents. Harbor layout with component parts **02 Hours**

Introduction to Traffic Engineering: Definition, objectives and scope of Traffic Engineering, factors affecting road traffic; Concepts of passenger car units for mixed traffic flow. **04 Hours**

A Site visit is recommended

Text Books:

1. Saxena and Arora, "Railway Engineering", DhanpatRai and Sons, New Delhi.
2. Khanna, Arora and Jain – Airport Planning and Design – NemchandRoorkee.
3. SrinivasanRHarbour, Dock & Tunnel Engineering, Charotar Publishing House.

4. Kadiyali, L.R. `Traffic Engineering and Transport Planning', Khanna Publishers
5. Khanna, S.K. Justo,C.E.G. and Veeragavan. A " Highway Material Testing", Nemchand and Bros, Roorkee, 2009

DEPARTMENT ELECTIVES

VII SEMESTER

Course Name	**Advanced Design of RC Structures**	Course Code	**16CV7DEADR**	SEE Duration	SEE+CIE
Credits	**03+00**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

Course Objectives:

To provide the knowledge of Design of RCC Structures like water tanks, different types of footings and retaining walls.

Course Outcome:

An ability to:

CO1: Analyze and design the components of water tank and curved beams

CO2: Analyze and design the components of slabs and foundations**.**

Design of Water Tanks:

Design of RCC OHT (Rectangular, circular) **8 Hours**

Beams curved in plan:

Introduction–Design Principles–Structural Design of beams curved in plan of circular and rectangular types. Deep Beams: Introduction – flexural and shear stresses in deep beams. **8 Hours**

Flat slabs:

Introduction, Components- I.S. Code Provisions – Design methods, Design for flexure and shear. **6 Hours**

Grid Floor Slabs:

Design of grid floor slabs by approximate methods **6 Hours**

Design of Culverts and Flyovers

Box and slab culvert, flyovers. **8 Hours**

TEXT BOOKS

1. Varghese P.C, Advanced Reinforced Concrete, Prentice Hall of India.
2. B C Punmia, Reinforced Concrete Structures, Vol-II, Laxmi Publications (P) Ltd, New Delhi.

REFERENCE BOOKS

1. P C Varghese, Limit State Design of Reinforced Concrete Vol-II, Prentice Hall of India (P) Ltd, New Delhi.
2. Jain A.K, Limit State Design of Reinforced Concrete, Nemchand & Bros., Roorkee.
3. Vazirani V N & M M Ratwani, Analysis of Structures- Vol-II, Khanna Publishers, New Delhi.
4. S. S. Bhavikatti, Advanced RCC Design-Vol-II, New Age International Publication, New Delhi.
5. IS Codes: IS: 456, IS:875, SP:16, SP:34.
6. H.J. Shah, Reinforced Concrete, Charoatr Publishers.

E-book

1. NPTEL-Course Material-nptel.ac.in.

Course Name	**Advanced Foundation Design**	Course Code	**16CV7DEAFD**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

Course Objectives:

Understand the need for having foundation and their types to suit the practical requirements. Develop an understanding about the requirements of foundations for their satisfactory performance.

Course Outcomes:

An ability to

CO1: Classify and suggest foundation type for various field and loading conditions, understand the basic requirements of a satisfactory foundation and the determinants of foundation location and depth, and proportion shallow foundations.

CO2: Estimate individual vertical and lateral pile load capacity, pile group capacity, and pile group efficiency.

CO3: Explain the causes of expansive nature of clays, simple methods to assess the swelling potential and methods to prevent and overcome swelling of expansive clays

SHALLOW FOUNDATIONS

Introduction, Types of shallow foundations. Basic requirements of satisfactory foundation - Location and depth criterion, stability criterion, settlement criterion. Determination of foundation location and depth. Bearing capacity theories-Terzaghi, Meyerhof, Skempton, Vesic and Brinch Hansen. Settlement of shallow foundation, types-immediate, consolidation and differential settlements. Principles of design of footing, proportioning of isolated, combined rectangular and trapezoidal footings (proportioning only) **12 hours**

PILE FOUNDATIONS

Introduction, Necessity of pile foundation, classification. Load carrying capacity by dynamic formula- Engineering News formulae and Hiley's formulae, static method, Correlations with SPT and CPT, Pile load test. Negative skin friction, pile groups, group action of piles in sand and clay, group efficiency, Concepts of Wave Equation Analysis (WAP) and Case Method Analysis by Wave Equation Analysis (CAPWAP) of Piles. Pile Driving Analyser(PDA) and Pile Integrity Test (PIT) **12 hours**

LATERALLY LOADED PILE FOUNDATIONS

Pile and pile groups subjected lateral loads. Batter piles, response to shear and moment loads, boundary conditions. Methods of design of laterally loaded vertical piles. Lateral load capacity by Reese and Matlock method (Elastic method) and Broms method (plastic method) **12 hours**

FOUNDATIONS ON EXPANSIVE SOIL

Introduction, Identification, Mineral structure, free swell test, Index properties of expansive soils, Definition of swell pressure, swell potential, their determination, CNS layer, foundation treatment for structures in expansive soil **3hours**

TEXT BOOKS

1. Murthy V.N.S., (2007) "Advanced Foundation Engineering", 1st Edition, C.B.S Publishers, Bangalore
2. Varghese P.C., (2007) "Foundation Engineering"- Prentice hall of India, New Delhi

REFERENCE BOOKS:

1. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
2. Braja, M. Das (2010), "Principles of Foundation Engineering", Seventh Edition, World Press.
3. Donald Coduto P (1994) "Foundation Design-Principles and Practices", Prentice Hall.
4. Relevant B.I.S codes.

E-BOOKS

1. http://nptel.ac.in/courses/105107120/

Course Name	**Geometric Design of Roads**	Course Code	**16CV7DEGDR**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To understand the design aspects of road geometrics to address the practical problems in highway engineering.

COURSE OUTCOME:

An ability to

CO1: select appropriate cross sectional elements of a roads

CO2: Analyse the horizontal alignment of a roads

CO3: Analyse the vertical alignment of a roads

CO4: Design various types of intersections of a roads

INTRODUCTION:

Importance of Geometric Design, Geometric Controlsand Criteria as per IRC and AASHTO standards and specifications, **PCU Concepts, factors controlling PCU for different design purpose 02 Hours**

CROSS SECTIONAL ELEMENTS:

Pavement surface characteristics – friction – skid resistance–Problems – pavement unevenness - light reflecting characteristics, Camber – objectives – types of camber – methods of providing cambers in the field – problems, Carriage way, Kerbs, Medians, Road margins, Roadway, Right of way, Design of Road humps as per latest IRC provisions. **08 Hours**

SIGHT DISTANCE:

Importance-Types, Stopping Sight Distance, Overtaking Sight Distance, Criteria for Sight Distance requirements, Sight distance at uncontrolled intersection, derivation, factors affecting sight distance, IRC standards and problems on above. **06 Hours**

HORIZONTAL ALIGNMENT:

Definition, Design Speed, Horizontal Curves, Superelevation, Radius of Horizontal Curve, Assumptions – problems – method of providing super elevation for different curves, Widening of Pavement on Horizontal Curves – objectives – Mechanical widening – psychological widening, Horizontal Transition Curve – objectives – Ideal requirements – Types of transition curve – Method of evaluating length of transition curve, Set-back distance on horizontal curve, **Curve Resistance** and problems on above**08 Hours**

VERTICAL ALIGNMENT:

Gradient – Types of gradient – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD – Night visibility considerations – Design standards for hilly roads – problems on the above. **08 Hours**

INTERSECTION DESIGN:
Principle – At-grade and Grade separated junctions – Types – Un-channelized Intersections, Channelized Intersections, **Rotary Intersection – Problems, Signalized Intersections. 06 Hours**

Text Books:

1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, "Highway Engineering", Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.
2. R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press (India) Private Ltd., 2012.

REFERENCE BOOKS:

3. L. R. Kadiyali& N. B. Lal, "Princple and Practice of Highway Engineering", Khanna Publications, 2005.
4. Relevant IRC Publications –such as IRC99, IRC-35, IRC-82, etc

E-BOOKS

1. nptel.ac.in/downloads/105101087/
2. http://freevideolectures.com/Course/91/Introduction-to-Transportation-Engineering/23

Course Name	**Groundwater Hydrology**	Course Code	**16CV7DEGHY**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

The objective of this course is to understand the ground water availability, flow and storage with relevant techniques of practical relevance.

COURSE OUTCOME:

An ability to

CO1: Explain the fundamental concepts of the occurrence and movement of groundwater

CO2: Estimate the ground water flow rate and flow direction using modeling techniques

CO3: Estimate the yield from a well and analyse the performance of a recharge well

CO4: Analyse the movement of pollutants in groundwater and explain the freshwater and groundwater interface

CO5: Explain various surface and subsurface groundwater investigation methods

INTRODUCTION:

Groundwater utilization &historical background, groundwater in hydrologic cycle, groundwater budget, and groundwater level fluctuations **3 Hrs**

OCCURRENCE AND MOVEMENT OF GROUNDWATER:

Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, groundwater basins & springs,

Darcy's Law, permeability & its determination, Dupuit assumptions, Groundwater flow rates & flow directions, general flow equations through porous media, Groundwater Interaction with Streams and Lakes **9Hrs**

WELL HYDRAULICS:

Steady/ unsteady, uniform/ radial flow to a well in a confined/ unconfined /leaky aquifer, partially penetrating/horizontal wells, testing for yield, Hydraulics of recharge wells. Concept & methods of artificial ground water recharge, wastewater recharge for reuse
10 Hrs

POLLUTION AND QUALITY ANALYSIS OF GROUNDWATER:

Sources of groundwater pollution, advection and dispersion, criteria & measures of ground water quality, ground water salinity, groundwater remediation 0**4 Hrs**

SALINE WATER INTRUSION IN AQUIFERS:

Ghyben-Herzberg relation between fresh & saline waters, shape & structure of the fresh & saline water interface, upcoming of saline water, saline water intrusion control **6 Hrs**

SURFACE/ SUB-SURFACE INVESTIGATION OF GROUND WATER:

Geological /geophysical exploration/ remote sensing / electric resistivity /seismic refraction based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation **7 Hrs**

TEXT BOOKS

1. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
2. K. R. Karanth, "Hydrogeology", TataMcGraw Hill Publishing Company.

REFERENCE BOOKS:

1. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000.
2. Bear J., Hydraulics of Groundwater, McGrow-Hill International, 1979.
3. Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice-Hall, 1987.
4. S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993.

Course Name	**Industrial Waste Water Treatment**	Course Code	**16CV7DEIWW**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

The principal objective of Industrial wastewater treatment is generally to allow industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment. The main aim of this course is to impart knowledge on the concept and application of industrial pollution prevention, cleaner technologies, industrial wastewater treatment and disposal of effluents.

COURSE OUTCOME:

An ability to

CO1: Describe the effects of industrial waste water on streams and treatment plants.

CO2: Explain the process of natural purification of streams and various pre-treatment methods.

CO3: Recognize sources, characteristics and treatment methods of industrial waste water.

INTRODUCTION:

Importance of treatment of industrial waste water, Difference between domestic and industrial wastewater, effects on streams and on Municipal Sewage treatment plants, and receiving water bodies. **6 Hours**

NATURAL PURIFICATION STREAMS:

Stream quality, dissolved oxygen Sag curve in Streams, Stream sampling, effluent and stream standards and legislation to Control water pollution. Streeter-Phelps formulation, Numerical problems on DO prediction. 0**6 Hours**

PRETREATMENT OF WASTE WATER:

A number of strategies will be examined for the pretreatment/treatment of Industrial waste water. The effects of various pretreatment methods are discussed independently and in combination. Pre-treatment method includes-Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning. 0**8 Hours**

TREATMENT METHODS:

Removal of Inorganic, Organic solids, suspended and colloidal solids, Treatment and disposal of sludge Solids. 06 **Hours**

COMBINED TREATMENTMETHODS:

Feasibility of combined treatment of industrial raw wastewater with Domestic Wastewater, Discharge of raw, partially treated and completely treated wastewaters to streams.
06 **Hours**

Case studies

Characteristics and Composition of waste water and Manufacturing processes of Industries like Paper and pulp, Cotton textile industry; Tanning Industry, cane sugar industry & distillery industry; Dairy industry; Steel and cement Industry, Pharmaceutical Industry.
08 **Hours**

TEXT BOOKS:

1. M.N.RAO AND A.K.DATTA (2015) - Wastewater Treatment.
2. Nemerow N.L., (2006) – Industrial Wastewater Treatment- Contemporary New York. Practice and Vision for the Future, Elsevier Science and technology.

REFERENCE BOOKS:

1. Ross **R.D. (1968), "Industrial Waste Disposal", Reinhold Environmental Series,**
2. Mahajan (1984) –" Pollution control in Process industries". TMH, New Delhi.
3. G.L.KARIA AND R.A.CHRISTIAN (2008) - Wastewater Treatment-concepts and Design Approach PHI learning, New Delhi-110001.
4. Eckenfelder (2000), "Industrial Water pollution Control"- McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA.

Course Name	**DESIGN AND DRAWING OF BRIDGES& IRRIGATION STRUCTURES**	Course Code	**16CV7DEDDB**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:0:1:0**	**3 Hours**	**50+50**

Course Objectives:

To enable the students to design basic types of bridges and irrigation structures and to prepare their drawings.

Course Outcomes:

An ability to:

CO1: Design and Draw different types of bridges.

CO2: Design and draw major hydraulic structures.

PART-A : Bridges

Introduction - Standard Specifications for Road Bridges – Indian Road Congress Standards – Carriage way Width & clearances – Design Loads – IRC Standard live loads – Basic Design Principles of Bridge Sub-Structures Design of Reinforced cement concrete slab culvert , Design of deck slab using Piguard's curves.

Bridge drawing using the data given for

a) RCC T – Beam and slab bridge

b) Steel Plate Girder Bridge for railways.

c) Slab culvert

PART –B IRRIGATION STRUCTURES

Design and Prepare detailed drawings of major hydraulic structures associated with irrigation. Drawing will be done to details furnished

a). Surplus weir

b). Canal Regulator

c). Canal drop

Text Book

1. N.KrishnaRaju, “Design of Bridges” Oxford & IBH Publishing Ltd. 4th Edition - 2009.

2. Ponnuswamy “Bridges Engineering” Tata McGrawHill– 2nd Edition, 20071. Arora KR “Irrigation Water Power & Water Resources Engineering”- - Standard Publishers Distributors – 2010.

3. C Satyanarayana Murthy “Water Resources Engineering: Principles and Practice” - New Age International Publishers - 2000.

4. P.N. Modi, “Irrigation, Water Resources, and Water”.

5. R.K. Sharma “Text Book of Irrigation Engineering and Hydraulic Structures” - Oxford and IBH Publishing Co., New Delhi.

6. B.C. Punmia and PandeLal, “Irrigation and Water Power Engineering” - Laxshmi Publications, New Delhi – 2009.

Question paper pattern:

Q1 is compulsory and answer any one full question from Q2 and Q3

Q1 – Theory questions for 30 marks from both bridge and irrigation.

Q2 – Part-A bridge drawing – 40 marks, Part B – Irrigation Drawing – 30 marks

Q3 – Part-A bridge drawing – 40 marks, Part B – Irrigation Drawing – 30 marks

Course Name	**Structural Dynamics**	Course Code	**16CV7DESDY**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:1:0:0**	**3 Hours**	**50+50**

Course Objective:
- Enable the students to understand time dependent response of linear systems
- To enable students to learn the physical behaviour of vibrating systems through experimental modules

Course outcomes:
An ability to
1. Compute natural frequency and free vibration response of SDOF systems
2. Set-up the equation of motion and obtain the Dynamic magnification factor of SDOF systems subjected to harmonic inputs
3. Set-up equation of motion of free-vibration response of MDOF systems and continuous systems, solve them to obtain natural frequencies (Eigen values) and mode shapes (Eigen vectors)
4. Conduct free vibration tests to obtain natural frequency and damping

1. **Introduction:** Introduction to Dynamical problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement, energy principles
2. **Dynamics of Single-degree-of-freedom systems**: Mathematical models of un-damped and damped SDOF system, Free vibration response of damped and un-damped systems, response to harmonic loading, support motion, evaluation of damping, vibration isolation, transmissibility, response to periodic forces. Numerical methods applied to SDOF, Direct integration and Duhamel integral, principle of vibration-measuring instruments–seismometer and accelerometer
3. **Dynamics of Multi-degree freedom systems and continuous systems**: Mathematical models of un-damped and damped MDOF systems, Free vibration of un-damped MDOF systems - Natural frequencies and mode shapes – orthogonality conditions, free vibration of damped MDOF systems, modal analysis – free and forced vibration with and without damping. Introduction to dynamics of continuous systems - free flexural vibration response uniform beams with various boundary conditions
4. **Introduction to experimental dynamics:** Free vibration - tests on SDOF and MDOF systems to obtain natural frequencies and mode shapes, obtaining damping through logarithmic decrement

Text Books:
1. *Mario Paz* , Structural Dynamics – Theory and computation, 4th edition, , Kluwer publication
2. *William T Thomson* ,Theory of Vibrations with application, 5th edition, , Pearson publication

Reference Books:

Anil K. Chopra ,Dynamics of Structures - -Prentice Hall of India

R.W. Clough &J.Penzien ,Dynamics of Structures --McGraw Hill

John M Biggs ,Introduction to Structural Dynamics--McGraw Hill pub

Schaum's outline series – Machanical vibrations-S Graham Kelly-McGraw Hill, India

M Mukhyopadhyay, Structural Dynamics--CRC Press, India

Subject	**MAJOR PROJECT (Phase-1)**	**Sub. Code**	**16CV7DCMAP**	
Credits	**02**	**SEE + CIE**	**50+50**	

Course Outcomes:

CO1: Identify a current problem through literature/field./case studies and define the background objectives and methodology for solving the same.

CO2: Write report and present it effectively.

The phase 1 of the project shall comprise of

- Problem identification in close collaboration with industry
- Literature Survey
- Deriving work content and carry out of project requirement analysis
- Submission of interim report
- Presentation to an expert committee

Evaluation guidelines to be developed

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VIII SEMESTER B.E

Course	Occupational Safety And Health Administration	course Code	16CV8IEOSH	SEE Duration
Credits	03	L:T:P	3:0:0	3 Hrs
Total Hrs.	40	SEE+CIE	50+50	

COURSE OBJECTIVES:

To introduce occupational safety and health as a vital tool for enforcing safe working conditions. The main aim of the course is to impart knowledge on the concept and application of safety and health issues at work environment.

COURSE OUTCOME
An ability to
CO1 : Demonstrate the knowledge of principles of safety and Legislation
CO2: Explain accident Investigation and Reporting
CO3: Recognize the various hazards and Risk analysis
CO4: Illustrate the various Occupational health and Toxicology issues.

UNIT I

Principles of safety:

History of Safety movement. Evolution of modern safety concept.-
general concepts of management planning for safety for optimization of productivity. Productivity, quality and safety line and staff. Functions for safety -budgeting for safety. safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection. 8Hrs

UNIT II

Laws and Legislation

Occupational safety and Health act, Guide lines, Occupational safety and Health administration, Right to know laws, EHS (environment, Health and safety) and its compliance. 4 Hrs

UNIT III

Accident Investigation and Reporting

Causes of an accident, reportable and non-reportable accidents, reporting to statutory authorities principles of accident prevention accident investigation and analysis records for accidents, departmental accident reports, documentation of accidents unsafe act and condition, domino sequence–supervisory role–role of safety committee cost of accident. Recommended practices for compiling and measuring work injury experience –permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices. 8Hrs

UNIT IV

Fire prevention and control

Sources of ignition –fire triangle–principles of fire extinguishing–active and passive fire protection systems–various classes of fires A, B, C, D, E–types of fire extinguishers–fire stoppers–hydrant pipes–hoses–monitors–fire watchers–lay out of stand pipes –fire station -fire alarms and sirens–maintenance of fire trucks–foam generators–escape from fire rescue operations–fire drills –notice -first aid for burns.

Sprinkler -hydrants-stand pipes–special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards–alarm and detection systems. Other suppression systems –CO2 system, foam system, dry chemical powder (DCP) system, halon system –need for halon replacement –smoke venting. Portable extinguishers –flammable liquids –tank farms –indices of inflammability-fire fighting systems. 8Hrs

UNIT V

Hazard risk analysis

Introduction, hazard, hazard monitoring -risk issue, group or societal risk, individual risk, voluntary and involuntary risk, social benefits Vs technological risk, approaches for establishing risk acceptance levels, Risk estimation.

Hazard assessment, procedure, methodology; safety audit, checklist analysis, what if analysis, safety review, preliminary hazard analysis(PHA), human error analysis, hazard operability studies(HAZOP),safety warning systems-Fault Tree Analysis and Event Tree

Analysis, Logic symbols, methodology, minimal cut set ranking -fire explosion and toxicity index(FETI), various indices-Hazard analysis(HAZAN)-Failure Mode and Effect Analysis(FMEA)-Basic concepts of Reliability

6 Hrs

UNIT VI

Occupational health and Toxicology

Concept and spectrum of health functional units and activities of occupational health services, pre-employment and postemployment medical examinations

-occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention –cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human system

6 Hrs

TEXT BOOKS:

1. Occupational safety and Health for Technologists, Engineers and Managers: Geotsch.D.L.Prentice Hall publishing.
2. Essentials of safety management: Kaila and singh, Himalaya publishing house.
3. Fire safety in Buildings. V.K.Jain, NewAge Publishers

REFERENCES:

4. National safety council of India, GOI Publication.
5. Loss prevention society of India publication
6. Industrial Accident prevention. Heinrich H.W. Mcgraw hill publication
7. Industrial accident prevention. Colling.D.A.Prentice hall publishing.
8. *nptel.ac.in/courses/107103004/35*
9. *nptel.ac.in/courses/112107143/40*

Course Name	Construction project management , finance and professional Ethics	Course Code	16CV8HSCMF	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2:0:0:1	3 Hours	50+50

COURSE OBJECTIVES:

To provide basic knowledge of project management and economics, concepts of contract and ethics in Civil Engineering profession..

COURSE OUTCOMES: An ability to:

CO1: Demonstrate the knowledge of organization structure of a project and apply scheduling techniques for managing construction projects.

CO2: Apply the concept of time value of money to different real time situations.

CO3: Analyse different economic feasible alternatives using present worth/rate of return methods of investment.

CO4: Examine the economics of a project and appraise financial statements

CO5: Apply professional ethics in engineering practice through case studies.

Project Organization, Introduction, Bar Charts, Work Breakdown Structure, Time estimates, Applications of CPM and PERT- Scheduling, Monitoring and Upating.

6Hrs

Engineering economics, Time value of money, discounted cash flow, NPV, ROR, Bases of comparison, Incremental analysis, and Benefit-Cost analysis – **6 Hrs**

Finance-Capital budgeting, Working capital management, Construction accounting, Income statement, Financial statements, Appraisal through financial statements-ratio's analysis, case studies– **6 Hrs**

Contracts – General conditions of contract, types of contracts, breach of contract, Arbitration **4Hrs**

Professional ethics- Importance, motivation, impact of violation of professional ethics on society, remedies case studies **4Hrs**

References:

1. Chitkara K K, "Construction Project Management, Planning, Scheduling and Controlling, McGraw Hill Education, 3rd Ed., 2014.
2. Srinath L.S, "**PERT and CPM**", East West Press Pvt Ltd New Delhi.
3. Van Horne J.C, "**Fundamentals of Financial Management**" Prentice Hall, 2009
4. Blank L and Anthony T, " Basics of Engineering Economy", McGraw Hill Education, Indian Edition, 2013.
5. K G Krishnamurthy, S V Ravindra**, "Professional Practice",** PHI, 2014
6. Wueste, Daniel E, '**Introduction, Professional Ethics and Social responsibility'**, Rowman and Littlefield Publishers, Inc. London, 1994

E-Resources:

Mooc: https://onlinecourses.nptel.ac.in/noc17_mg01/preview

http://nptel.ac.in/courses/109104068/30

DEPARTMENT ELECTIVES

VIII SEMESTER

Course	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	Course Code	16CV8DEERD	SEE Duration	SEE+CIE
Credit	03	L-T-P	3:0:0	3hrs	50+50

COURSE OBJECTIVES:
- The knowledge of structural dynamics shall be utilized to introduce the students to (a) engineering seismology and (b) concepts for earthquake resistant design
- Design and detailing aspects to achieve ductility in structures shall be emphasized

PRE-REQUISITE:
Structural Dynamics

Course outcomes;
CO1: Describe the fundamentals of engineering seismology
CO2: Characterize the Earthquake ground motions and prepare the basis for estimation of seismic forces
CO3: Analyse , design and detail , buildings for seismic resistance through concepts of ductility as per BIS codes
CO4: Identify and comprehend failure patterns of buildings during earthquake

Introduction to engineering seismology, seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments.

Seismic response of buildings, structures and sites, study of response of buildings and structures during past earthquakes.
The Response Spectrum – elastic and elasto-plastic spectra, tripartite plot, use of response spectrum in earthquake resistant design.

Dynamics of multi-storeyed buildings – natural frequencies and mode shapes, Analysis of multi-storeyed buildings, obtaining seismic forces using IS-1893.
Structural Configuration for earthquake resistant design, frames, shear walls and dual systems, Effect of infill masonry walls on frames, problems of the soft first-storey, Capacity design procedures.

Ductility and energy absorption in buildings, Reinforced concrete for earthquake resistance, confinement of concrete for ductility, ductility of columns and beams – codal provisions

Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings.

TEXT BOOK AND CODES:

1. P Agarwal and M Shrikande, "Earthquake Resistant Design of Structures", Prentice Hall (India) Ltd, New Delhi, 2006.
2. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
3.

REFERENCE BOOKS:

1. D J Dowrick, "Earthquake Risk Reduction"- John Wiley and Sons, 2003
2. Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw Hill Pub.
3. G GPenelis and A J Kappos, "Earthquake Resistant Concrete Structures", Chapman and Hall, 1999
4. T Paulay and M J N Priestley, "Seismic Design of Reinforced Concrete and MasonryBuildings", John Wiley and Sons, 1992
5. S.K.Duggal, (2007), "Earthquake Resistant Design of Structures", OxfordUniversity Press, New Delhi 2007.
6. Steven L Kramer, "Geotechnical Earthquake Engineering", Pearson Education pub.
7. Anil K Chopra, "Dynamics of Structures – Theory and Application to Earthquake Engineering"- 2nd ed., Pearson Education pub.
8. Anderson,R.A., "Fundamentals of Vibrations"- McMillan
9. Clough and Penzien, "Dynamics of Structures"- McGraw Hill
10. Mukyopadhyaya, "Vibration and Structural Dynamics", Oxford &IBH
11. James Ambrose and Dimitry Vergun, "Design for Earthquakes"-avid Key, "Earthquake Design Practice for Buildings".

Course Name	Environmental Impact Assessment	Course Code	16CV8DEEIA	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3:0:0:0	3 Hours	50+50

COURSE OBJECTIVES:

To introduce the methodology of environmental impact assessment (EIA) as a vital tool for sound environmental management and decision-making. This course will explore the need for environmental impact assessments, the different types of assessments, and the regulatory and technical requirements of preparing an assessment.

COURSE OUTCOME:

An ability to

CO1: Explain the major principles and mechanisms of Environmental Impact Assessment.

CO2: Describe the different stages of Environmental Impact Assessment in India.

CO3: Illustrate the process of issues concerning societal, ethical and legislative needs.

INTRODUCTION:

Definition, Evaluation of EIA in India, Development activity and Ecological factors, Relationship between EIA, EIS, and FONSI. Purpose and Need for EIA studies, Base line information. **6 Hrs**

FUNDAMENTAL APPROACH TO EIA/ EIA PROCEDURES:
Step- by- step procedure for conducting EIA, Advantages and Limitations of EIA. Hierarchy in EIA. Statutory Requirements in EIA, MoEF Guidelines in Siting Developmental Projects.

6 Hrs

Methodologies of EIA:

Contents of EIA. Methodologies and Evaluation Techniques of EIA, their selection for Specific Projects. Frame work of impact Assessment related to Indian conditions. **6 Hrs**

ENVIRONMENTAL ATTRIBUTES:
Assessment and prediction of impacts on Attributes -Air, Water, Noise, Land, Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for development projects, Rapid and comprehensive EIA. **6 Hours**

PUBLIC PARTICIPATION IN EIA:

Basic Definitions, Regulatory Requirements, Objectives, Advantages and Disadvantages, Selection of Public Participation Techniques. **6 Hours**

IMPACT QUANTIFICATIONS:
EIA for Water resource developmental projects, Highway projects: Nuclear Power plant projects, Hazardous Waste disposal Sites, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities. **9 Hours**

Text Books:

1. **Environmental Impact Assessment** –L.W.Canter (1996), McGraw Hill Inc.

2. **Environmental impact Assessment methodologies** - Anjaneylu.Y.

Reference Books:

1. **Environmental Impact analysis** - Jain R.K, Urban & Stacey—Van Nostrand Reinhold Co

2. **Guidelines for EIA of Developmental Projects**. Ministry of Environment and Forests, Government of India.

E-BOOKS:

1. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm
2. nptel.ac.in/courses/105101084/https://ay14-15.
3. moodle.wisc.edu/prod/course/view.php?id=499.

Course Name	**Geotechnical Earthquake Engineering**	Course Code	**16CV8DEGEE**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To provide basic knowledge about Dynamic soil properties, Causes and mitigation of Earthquakes, measurement of Earthquakes, and Design of earthquake resistant of foundations and retaining walls.

COURSE OUTCOME: An ability to

CO1: Explain the basic concepts of earthquake, its causes, evaluation and mitigation.

CO2: Identify dynamic soil properties and Compute factor of safety against liquefaction

CO3: Design earthquake resistant shallow foundations and retaining walls

INTRODUCTION:

Historical background, earthquake records of India, Plate tectonics, causes, Seismic waves, faults types, hypocenter, epicenter, focal depth, seismograph, parameters of ground motion, measurement of ground motion-accelerometers, magnitude and intensity of earthquake and its relationship , seismic zones, risk evaluation and mitigation, earthquake resistant structures, awareness campaign **8Hrs**

Fundamentals of Vibrations:

Introduction, Fundamental definitions, System with single degree of freedom, Free and Forced vibration of a spring-mas system, Free and steady-state forced vibration with viscous Damping, Rotating –mass-type Excitation, Determination of Damping Ratio, Vibration-measuring Instruments, System with two degrees of freedom-vibration of a mass-spring system and problems. **8 Hrs**

Dynamic soil properties

Introduction, soil properties for dynamic loading, Lab-field measurement, factors affecting ground motion, peak horizontal ground acceleration. **4Hrs**

Liquefaction

Introduction, factors governing, liquefaction Analysis- cyclic stress ratio, remedial measures for liquefaction, numerical problem on factor of safety against liquefaction. **4 Hrs**

Design of earthquake resistant shallow foundation and deep foundation

Introduction, Bearing capacity analysis for liquefied soil, granular soil with earthquake induced pore water pressure, analysis for cohesive soil weakend by earthquake, and concepts of design criteria for deep foundation – piles 0**8 Hrs**

Retaining wall analysis for earthquakes:

Introduction,.pseudostatic method, method of analysis for liquefied soil, analysis for reinforced concrete retaining walls, sheet pile walls, and braced excavation 0**7Hrs**

TEXT BOOKS:

1. **Basic geotechnical earthquake Engineering, -**Kamalesh Kumar, New age international publishers, first edition, (2008)
2. **Principles of Soil Dynamics -**Braja M. Dass, and G.V. Ramana, CL Engineering publishers; second edition (2010)

REFERENCE BOOKS:

1. ***Soil dynamics and machine foundations-*** Swami saran, Galgotia Publications, New Delhi
2. ***Geotechnical Earthquake Engineering-***Steven L Kramer, Pearson publication, first edition (1996)

E-Resources:

1. **Nptel courses**: http://nptel.ac.in/courses/105101134/

Course Name	Integrated Watershed Management	Course Code	16CV8DEIWM	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	3:0:0:0	3 Hours	50+50

COURSE OBJECTIVES:

Objective of this course is to understand fundamental concepts of watershed behavior, planning and management, various methods available to estimate runoff and quantify soil erosion. Also the course helps to understand the techniques for the assessment of management of flood and droughts, the concepts of conjunctive use of water resources for effective watershed management.

COURSE OUTCOME:

An ability to

CO1: Explain the fundamental concepts of watershed behavior and watershed management and explain the application of modern techniques in watershed management

CO2: Apply different models to estimate runoff and soil erosion from a watershed

CO3: Identify the types and sources of water pollution

CO4: Apply various methods to assess / model flood and drought

INTRODUCTION:

Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making **3 Hrs**

INTEGRATED WATERSHED MANAGEMENT:

Integrated water resources management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; conjunctive use of water resources, rainwater harvesting, water conservation and recycling, Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Watershed Management Practices in Arid and Semiarid Regions, Case studies. **7 Hrs**

WATERSHED MODELING:

Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-runoff process, subsurface flows and groundwater flow

Soil erosion, estimation of soil erosion **10 Hours**

MANAGEMENT OF WATER QUALITY:

Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality 0**6 Hours**

STORM WATER AND FLOOD MANAGEMENT:

Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage

Drought Management:

Drought assessment and classification, drought analysis techniques, drought mitigation planning. **9 Hours**

USE OF MODERN TECHNIQUES IN WATERSHED MANAGEMENT:

Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management
4 Hours

TEXT BOOKS

1. Vir Singh, Raj, Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

REFERENCE BOOKS:

1. Allam, Gamal Ibrahim Y., Decision Support System for Integrated WatershedManagement,< Colorado State University, 1994.
2. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
3. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
4. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.

5. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.
6. V.P. Singh & Donald K. Frevert "Watershed Models" Taylor & Francis
7. E.M. Tideman "Watershed management :Guidelines for Indian Conditions" Omega Scientific Publishers

E-BOOKS

1. http://nptel.ac.in/syllabus/105101010/
2. http://nptel.ac.in/syllabus/105107068/

Course Name	**Reinforced Earth Structures**	Course Code	**16CV8DERES**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To provide basic knowledge of Reinforced Earth structures, materials used, their properties and the design procedures for Reinforced Earth retaining walls and roads.

COURSE OUTCOME: An ability to

CO1: Explain the basic concepts and components of Reinforced Earth constructions.

CO2: Classify geosynthetic materials, and outline their properties

CO3: Design Reinforced Retaining walls and pavements; summarize various applications of geosynthetics in civil Engineering

INTRODUCTION:

Historical background, development of concept of reinforced soil, Mechanism of reinforced soil, advantages of reinforced earth structure over similar structures.
03 Hours

BASIC COMPONENTS OF REINFORCED SOILWALL:

Introduction, general, **Soil or fill-matrix**- choice of soil, backfill criteria. Reinforcement bars, Metallic strips, Metallic grids, sheet reinforcement. **Facing Elements**- metal facing and concrete panel facing. **03 Hours**

MATERIALS:

Introduction and overview, Historical developments, Recent developments. Classification based on materials, Geosynthetics – geotextiles, geogrids, geomembranes, geocomposites, geonets and other products, geomats, geomeshes, geowebs, natural geotextiles, basic functions etc. **06 Hours**

PROPERTIES, TESTING & EVALUATION OF GEOSYNTHETICS:

Physical properties- (type of structure, specific gravity, mass per unit area, thickness and stiffness).

Mechanical properties- (index and performance properties)-tensile properties (grab tension test); compressibility property; seam strength; burst strength; tear strength and puncture strength; friction; pull out resistance.

Hydraulic properties-porosity; percentage open area; apparent opening size; permittivity; transmissivity; soil retention.

Endurance properties- Installation damage; creep and stress relaxation; abrasion and clogging;

Degradation of geosynthetics due to temperature, oxidation, hydrolysis, chemical action and ultraviolet Testing & Evaluation- Hydrodynamic sieving test, Permeability test, Transmissivity test, Geotextile-Soil Filtration test etc.

09 Hours

DESIGN OF REINFORCED EARTH STRUCTURE:

Introduction, principles of design, Internal and external stability, Design of retaining walls using metallic strips , Design of pavement using geogrids, concepts of embankments on soft soil , reinforced soil slopes, and bearing capacity improvement.

12 Hours

APPLICATION OF GEOSYNTHETICS:

Use of geosynthetics in Civil engineering for filtration and drainage, uses in roads, use in landfills, **Future trends in geosynthetic applications-**Combined geosynthetics, smart geosynthetics, active geosynthetics, Case studies.

06 Hours

TEXT BOOKS:

1. **Designing with Geosynthetics**- Koerner. R.M. - Prince Hall Publication, 1994.
2. **Reinforced soil and its Engineering Applications** – Swami Saran., I.K. International Pvt. Ltd.

REFERENCE BOOKS:

1. **Earth reinforcement and Soil structure**- Jones CJEP- Butterworths, London, 1996.
2. **Earth Reinforcement Practices** - Hidetoshi Octial, Shigenori Hayshi& Jen Otani - Vol. I, A.A. Balkema, Rotterdam, 1992.
3. **Reinforced Earth**- Ingold, T.S. - Thomas, Telford, London.
4. **Geosynthetics in Civil Engineering –** Edited byR.W. Sarsby, CRC Press, Boca Raton**.**
5. **Geosynthetics** - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.

E-Resources: Nptel courses: http://nptel.ac.in/downloads/105106052/

Course Name	**Urban Transport Planning**	Course Code	**16CV8DEUTP**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3:0:0:0**	**3 Hours**	**50+50**

COURSE OUTCOME:

An ability to

CO1: Outline the types of surveys to provide the data required for transportation planning

CO2: Develop trip production models & compute trip attraction rates

CO3: Develop various trip distribution models & calibrate using gravity model

CO4: Build aggregate mode split models &analyse transportation network flows

CO5: Discuss characteristics of mass transit systems

INTRODUCTION:

Characteristics of different modes of transportation; Principles of co-ordination and operation control, Elements in urban transit system **03 Hours**

TRANSPORTATION PLANNING PROCESS:

Interdependence of Land Use and Traffic, Systems Approach, **Stages in Transport Planning.** **04 Hours**

TRANSPORT SURVEYS:

Study Area, Zoning, Planning of different types of surveys and interpretation, travel demand; Traffic surveys for mass transit system planning. **08 Hours**

TRIP GENERATION:

Trip Purpose, Factors governing Trip Production and Attraction, **Trip Production Models**, Category Analysis. **06 Hours**

TRIP DISTRIBUTION:

Methods of trip distribution, Application of gravity model, Calibration of gravity model, Problems. **08 Hours**

MODAL SPLIT AND TRIP ASSIGNMENT:

Factors affecting modal split; Modal split in transport planning; Purpose of Trip Assignment, principles of traffic assignment; Assignment techniques **06 Hours**

MASS TRANSIT SYSTEMS: -

Types-characteristics-objective and Planning- Current developments in India **04 Hours**

Text Books:

1. Kadiyali, L.R., 'Traffic Engineering and Transportation Planning' – Khanna Publication, 2011.

2.C. JotinKhisty& B. Kent Lall, "Transportation Engineering-An Introduction", Prentice Hall of India Private Limited, Third Edition, New Delhi, 2006.

REFERENCE BOOKS:

AdibKanafani, "Transportation Demand Analysis", McGraw Hill Book Company, New York.

Juan de Dios Ortuzar& Luis G. Willumsen, "Modelling Transport" 4th Edition, Wiley

E-BOOKS

nptel.ac.in/courses/105107067/

nptel.ac.in/downloads/105106058/

VIII SEMESTER CIVIL ENGINEERING

Subject	**INDUSTRIAL TRAINING**	**Sub. Code**	**16CV8DMITP**
Credit	**2**	**CIE +SEE**	**50 +50**

All the students are encouraged to undergo a minimum of 4 weeks industrial training in an ongoing construction project and submit a report consisting the details of the organization, project details and specific construction aspect which they have learnt during that period for CIE to be recognized as an audit course.

VIII SEMESTER CIVIL ENGINEERING

Subject	**MAJOR PROJECT Phase -2**	**Sub. Code**	**16CV8DCMAP**
Credits	**10**	**SEE+CIE**	**100+100**

Course Outcomes:

CO1: Identify a current problem through literature/field./case studies and define the background objectives and methodology for solving the same.

CO2: Analyse, design and develop a technology/process

CO3: Implement and evaluate the technology at the laboratory level

CO4: Write report and present it effectively.

The Phase II of the project shall consist of

- Experimental design/set-up
- Experimental work/studies
- Report Writing
- Evaluation of project report by the internal /external guides

May be carried out using in-house facilities or in an industry by specified number of students in a group.

HSS ELECTIVE

VIII SEM

Course Name	LAW FOR ENGINEERS	Course Code	16HS8DELFE	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2-0-0-1**	**3 Hours**	**50+50**

Course Objective

To examine and review the laws complying with environment, health and safety.

Course Outcomes

After the completion of the course the students will be able to

CO1: Enumerate the principles of sustainable development.

CO2: Discuss the significance of various legislations pertaining to civil engineering.

Environmental Law Origin of Environmental Law, Concept of Pollution – Sources of Pollution, Types of Pollution, and Effects of Pollution. Nature and Scope of Environmental Law – Importance. Case study. **6HRS**

Labour Law

Provisions of various labor laws-Workmen's Compensation Act 1923; Disablement, Total Permanent disablement, Temporary disablement, Formula for compensation; Minimum wages act, 1948; Payment of bonus Act, 1965; Weekly holidays Act, 1942; Payment of Wages Act, 1936; Employees Insurance Act, 1948. **8 HRS**

Indian Penal Code

A brief introduction to criminal liability of civil engineers in constructions as per the Indian Penal Code.
6 HRS

IPR and Law of Torts

Definition, categories of torts, Breach of Duty and Damages. **6 HRS**

Text/Reference books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. Ratanlal and Dhirajlal&: The Law of Torts.
3. S. Shantha Kumar- Introduction to Environmental Law.
4. Madhavan Pillai - Labour and Industrial Laws.
5. Bare Acts referred to above.

Reference books:

1. VR.Krishna Iyer-Environmental pollution and the law.
2. Suresh Jain and Vimal Jain- Environmental law in India.
3. Goswami VG- Labour and Industrial law.
4. Indian law Institute- Law and labour management relations in India.
5. Avtar Singh- The law of torts.

Course Name	**MANAGEMENT AND ENTREPRENEURSHIP**	Course Code	**16HS8DEMAE**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2-0-0-1**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To prepare students with broad understanding of business as well as more focused learning in key management areas. The course also equip the students to think like entrepreneurs.

COURSE OUTCOMES:

An ability to,

CO1: Discuss the importance of management and its approaches.

CO2: Explain the various features and environment of management process.

CO3: Summarize types, characteristics, schemes, and policies of entrepreneurship

CO5: State various funding support available to entrepreneurs.

CO6: Prepare project reports for decision making.

PART - A (MANAGEMENT)

UNIT – 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Evolution of Management Thought. Management as a science or art of profession. Scope and functional areas of management. 02 Hrs

UNIT – 2

Functional areas of Management: **Planning -** Nature, Planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans. 10Hrs

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization – Types of organization - Departmentation - Committees – Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing.

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Communication - Meaning and importance –Coordination, meaning and importance and Techniques of Co -ordination. Meaning and steps in controlling - Essentials of a sound control system.

UNIT – 5 10 Hours

ENTREPRENEUR: Entrepreneurship- definition. Types of Entrepreneur, Intrapreneur. Growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

Laws Concerning Entrepreneur: partnership laws, business ownership, sales and income taxes and workman compensation act. 5 Role of various national and state agencies which render assistance to small scale industries.

UNIT-8

PREPARATION OF PROJECT : Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.
04 Hrs

RECOMMENDED BOOKS:

1. Principles of Management – P.C. Tripathi, P.N. Reddy – Tata McGraw Hill, 2007.

2. Dynamics of Entrepreneurial Development & Management – Vasant Desai:, Himalaya Publishing House, 2007.

3. Management Fundamentals Concepts, Application, Skill Development – Robert Lusier – Thompson, 2007.

REFERENCE BOOKS:

1. Entrepreneurship Development – Poornima M Charanthimath Pearson Education 2006.
2. Entrepreneurship and management - Shashi k Gupta- Kalyani publishers, Latest edition.

Course Name	Basics of Marketing and Sales	Course Code	16HS8DEBMS	SEE Duration	SEE+CIE
Credits	03	L-T-P-S	2-0-0-1	3 Hours	50+50

COURSE OBJECTIVES:

To prepare students with basic knowledge in Marketing and Sales

COURSE OUTCOMES:

Upon successful completion of the course the student will be able to

CO1: Outline the basic principles of marketing and sales

CO2: Discuss strategies and types of marketing and pricing of new products

CO3: Explain concepts of sales management and role of sales manager

CO4: Demonstrate knowledge of online marketing

CO5: Exemplify related case studies

Introduction to Marketing: 5 Hours

Definitions of market, marketing, Marketing Management Orientation- production, product, selling, marketing and societal marketing, marketing environment, marketing research

Customer driven Marketing strategy& mix 7 Hours

Market Segmentation- bases, Market targeting- strategies, Positioning, basics of Marketing mix – product- levels, Individual product and service decisions, price- broad categories of new product pricing, place- channel member tasks and channel levels, promotions- the promotion mix

Introduction to sales Management 6 Hours

Meaning, Importance, Personal selling, Trends in Sales management, qualities and responsibilities of a sales manager, selling skills, selling process

Online Marketing & Selling on the Internet 6 Hours

Marketing and the Internet, Online Marketing Domains, Online Marketing Presence, internet based selling- Internet trading in India

Case studies 2 Hours

Case studies pertaining to Indian and global contest

TEXT BOOKS

1. Marketing Management: A South Asian Perspective, Kotler , Keller, Koshy & Jha, 13/e, , 2012, Pearson.
2. Sales Management, Tapan Panda & Sunil Sachdev, 6/e, 2003, Oxford University Press.

REFERENCE BOOKS:

1) Marketing Management: A Strategic Decision Making Approach, RamaswamiNamakumari, 5/e, 2013, McGrawHill Education

2) Marketing, Etzel, Stanton, Walker&Pandit, 14/e, 2009, McGraw Hill Education

3) Principles of Marketing Management, Kotler, Armstrong, Agnihotri, Haque, 13/e, 2010, Pearson

4) Sales Management: Teamwork, Leadership and Technology, Charles, Futurell, 6/e, 2001, Thomson South Western

5) Sales & Distribution Management, Havaldar and Cavale, 2/e, 2011, McGraw Hill Education

Course Name	**Economics for Engineers**	Course Code	16HS8DE EFE	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2-0-0-1**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To familiarize students with of the basic concepts of economics, understand the micro and macro aspects and to apply them in the Engineering profession.

COURSE OUTCOMES:

An ability to,

CO1: Comprehend basic principles of Economics in Engineering.

CO2: Explain the fundamental concepts of supply and demand and apply them for functioning of a firm and industry in civil engineering.

CO3: Perform cost and production analysis, assess profits, calculate BEP and Payback period for decision-making.

CO4: Discuss concepts of macroeconomics and identify indicators to evaluate the economics in construction industry.

CO5: Explain Banking and financial system and related policies

CO6: Outline the importance of public Economics, Welfare, and Distribution of Wealth.

Introduction to Economics

Economics – Meaning, Nature, Scope and Significance, Micro and Macro Economics, the Logic of Economics. The three problems of Economic Organization, Society's technological possibilities, Market Mechanism.

Self-Study: The role of Government in a mixed economy **4 Hrs**

Fundamental Concepts, Supply and Demand

Opportunity Cost, Equi-Marginal Principle, Time perspective, Incremental Concept, Time Value of Money, The Demand Schedule, Supply, Equilibrium, Law of Demand, Elasticity of Demand, Law of Supply, Factors Affecting Demand and Supply. **6 Hrs**

Self-Study: Demand and Supply in Construction industry.

Cost Analysis and Production Analysis

Concepts, Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve. Concepts, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Economies of scale, Diseconomies of scale. Break Even Analysis – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions. **6 Hrs**

Self-Study: Opportunity Costs and Markets

Macro Economics

Concepts, Aggregate Demand and Supply, Measuring Economy, GDP, Money Supply, Interest Rates, Consumption, Savings, Investment, Business Cycles **4 Hrs**

Self-Study: Economic cycles in India and Construction Industry

Money and Financial System

Financial System, Banking, Capital Market, Central Bank and Functions, Monetary Policy, Fiscal Policy, EX-IM Policy, Industrial policies of the past and present. **4 Hrs**

Self-Study: LPG Policy and developments in infrastructure sector.

Economic Growth

Population Growth and Development, Unemployment, Economic Consequences of Government Debt, Stabilizing the economy, Economic Growth and Human Welfare **2 Hrs**

Self-Study: Technological Advances and Economic Growth

TEXT BOOKS

1) Indian Economy, Datt and Mahajan, 64th revised edition, 2012, S.Chand
2) Economics, Samuelson and Nordhaus, 19th edition, 2010, McGraw Hill Education – India

REFERENCE BOOKS:

1) Principles of Economics, Mankiw Gregory N., 2002, Thompson Asia
2) Managerial Economics, V. Mote, S. Paul, G. Gupta, 2004, Tata McGraw Hill
3) Indian Economy, Misra, S.K. and Puri, 2009, Himalaya
4) Textbook of Business Economics, Pareek Saroj, 2003, Sunrise Publishers

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BMS COLLEGE OF ENGINEERING, BANGALORE-560 019
(Autonomous College under VTU)

DEPARTMENT OF CIVIL ENGINEERING

Semester: III (2015 onwards)

Code	Course Title	Teaching Dept.	Credits				Total Credits	Contact Hours	CIE MARKS	SEE MARKS	TOTAL MARKS
			L	T	P	S					
15MA3GCMAT	Engineering Maths –III (BS)	MATHS	3	-	-	-	3	3	50	50	100
15CV3DCBMC	Building Materials & Construction (ES)	CIVIL	3	-	-	-	3	3	50	50	100
15CV3DCGEO	Engineering Geology (BS)	CIVIL	2	-	1	2	5	4	50	50	100
15CV3DCBSY	Basic Surveying (ES)	CIVIL	2	-	1	2	5	4	50	50	100
15CV3DCMOF	Mechanics of Fluids (ES)	CIVIL	3	1	-	-	4	5	50	50	100
15CV3DCSOM	Strength of Materials (ES)	CIVIL	3	1	1	-	5	7	50	50	100
			Total				**25**	26			**600**

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

III SEMESTER CIVIL ENGINEERING

Course Name	**Engineering Maths –III**	Course Code	**15MA3GCMAT**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3-0-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

The purpose of the course is to make the students well conversant with Fourier- Series, Fourier Transforms, formulate physical problems in terms of Partial Differential Equations, find insight into the physical behaviour of systems from mathematical solution and develop computational skills using efficient numerical methods for problems in science and engineering.

COURSE OUTCOMES:

CO 1: Express given functions to form Fourier series.

CO 2: Demonstrate an understanding of Fourier transforms techniques.

CO 3: Employ analytical techniques to solve partial differential equations with appropriate boundary conditions.

CO 4: Compute the solution of a system of algebraic equations

CO 5: Use calculus of variations to find the extremal of a functional

MATRICES:

Introduction: Elementary row transformations, Echelon form of a matrix, rank of a matrix by elementary row transformations.

Consistency of system of linear equations and solution. Solution of a system of non-homogenous equations: Gauss elimination method, LU decomposition method, Gauss-Seidel method. Eigenvalues and eigenvectors of matrices.

Applications: Stability of a system of differential equations- an eigenvalue problem.

Suggested Reading: Inverse of a matrix using Gauss-Jordon method. Eigen value and corresponding eigenvector using Rayleigh power method, reduction of matrix to diagonal form.

7 Hours

FOURIER SERIES:

Introduction: Periodic function, Dirichlet's conditions, statement of Fourier Theorem, Fourier series of periodic function of period 2π and arbitrary period, practical harmonic analysis.

Applications: Fourier series of typical waveforms used in communication engineering-saw toothed waveform, triangular waveform, square waveform, half-wave rectifier, full wave rectifier and modified saw tooth waveform.

Suggested Reading: Half range Fourier series, Fourier series of discrete functions, Complex Fourier series.

7 Hours

FOURIER TRANSFORMS:

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms,

Suggested Reading: Convolution theorem, Fourier transforms of the derivatives of a function, Parseval's identities and physical significance of Parseval's identities.

7 Hours

PARTIAL DIFFERENTIAL EQUATIONS:

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- The linear equation $P\,p + Q\,q = R$ (Lagrange's partial differential equation).

Applications: One-dimensional heat equation and wave equation (without proof), various possible solutions of these by the method of separation of variables.

Suggested Reading: Direct integration method, method of separation of variables, D'Alembert's solution of wave equation. **8 Hours**

CALCULUS OF VARIATIONS:

Variation of function and functional, Euler's equation, variational problem, isoperimetric problems

Applications: Geodesics of a right circular cylinder, minimal surface of revolution, hanging cable. Brachistochrone problem.

Suggested Reading: Minimal surface of revolution, Geodesics of a right circular cone and sphere **7 Hours**.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 40th edition, 2007, Khanna Publishers.
2. Advanced Engineering Mathematics, 5th edition by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
3. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
4. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition Vol.1 and Vol.2, 2014, Wiley-India.

EXPERIMENTS/EXERCISES:

- Solution of system of algebraic equations using Gauss Seidel method
- LU decomposition of matrices.
- Eigenvalues and eigenvectors of matrices-stability of a system of differential equation-Eigenvalue problem.
- Largest eigenvalue and corresponding eigenvector of a matrix.
- Diagonalisation of matrices

III SEMESTER CIVIL ENGINEERING

Course Name	**Building Materials and Construction**	Course Code	**15CV3DCBMC**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3-0-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable students to gain knowledge on various materials and processes involved in building construction. This will enable the students to apply the knowledge for building planning and drawing.

COURSE OUTCOMES:

CO1: Describe the physical and mechanical properties of a variety of construction materials.

CO2: Describe the functional components of a building.

CO3: Describe the construction process of various components of a building.

INTRODUCTION TO BUILDING MATERIALS

Physical and mechanical properties, parameters to define strength, durability and performance for the following materials.

STRUCTURAL CLAY PRODUCTS: Bricks, types of bricks, manufacturing process of bricks.

NATURAL STONE: Types, qualities of good stone for construction.

TIMBER: Natural Timber, properties, Timber products.

LIME AND CEMENT: Properties and manufacturing process.

OTHER BUILDING MATERIALS: Iron and Steel, Paints and enamels, water proofing materials

12 hours

INTRODUCTION TO BUILDING CONSTRUCTION:

Building components viz. foundations, walls, lintels roofs, openings, framed structures and masonry structures.

FOUNDATION

Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations.

3 hours

MASONRY

Definition of terms used in Masonry, Classification of Masonry, Bonds in Brick work, Reinforced Brick Masonry, Joints in stone masonry, Introduction to load bearing, cavity and partition walls.

4 hours

DAMP PROOFING, WATER PROOFING AND ANTITERMITE TREATMENT

Definition of technical terms, Defects, causes and sources of dampness, damp proofing and terrace water proofing methods, Pre and post constructional antitermite treatment.

3 hours

DOORS AND WINDOWS

Definition of technical terms, Location of doors and windows, Types of Doors, Types of windows.

3 hours

ARCHES, LINTEL AND BALCONY

Elements of an arch, Classification of arches, Definition and classification of Lintels, Definition and functions of Chejja, Canopy & Balcony

3 hours

ROOFS AND FLOORS

Types of Roofs & Roofing materials, Types of flooring, Factors affecting selection of flooring materials, Flat roof (RCC), Types of pitched roofs.

5 hours

STAIRS

Definition of technical terms, Requirements of good stair, Types of Stairs, Geometrical design of RCC Dog legged (Plan and sectional elevation).

3 hours

PLASTERING AND PAINTING

Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering, Introduction to Paintings, Purpose of Painting and Defects in Painting.

3 hours

TEXT BOOKS:

1. **A Text Book Building Materials**, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication., 2nd Edition,.2015

2. **Building Construction,** Sushil Kumar, Standard Publication and Distributors, New Delhi, 19th Edition, 2001.

REFERENCE BOOKS:

1. **Advances in Building Materials and Construction** by Mohan Rai and M.P. Jain Singh – publication by CBRI, Roorkee.
2. **Building Materials (3rd revised edition)**, S.K. Duggal, New Age International publishers, India.
3. **Building Construction**, by Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain,Laxmi Publications Pvt Ltd.

III SEMESTER CIVIL ENGINEERING

Course Name	**Engineering Geology**	Course Code	**15CV3DCGEO**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**2-0-1-2**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

1. Study of internal structure of the earth.
2. Identification and description of Minerals and Rocks based on their index properties.
3. Study of structural features (Folds, Faults, and Joints etc) of the rocks and earth and their engineering consideration.
4. Study of various Geological Maps.
5. The study of Geotechnical and groundwater potential Zones using various Techniques.
6. The study and select good building stones, sites for construction of dam, reservoir, wells and tunnels.

COURSE OUTCOMES

CO1: Explain the structural features of the earth. Identify and classify minerals and rocks.

CO2: Provide decision support on Lithological characters and related groundwater conditions.

CO3: Describe various geological maps and interpretation of geological data for tunneling, mining and mineral excavations.

CO4: Identify the suitable site for the Civil Engineering project by providing remedial measures in the structurally disturbed areas with the help of Geological investigation.

INTRODUCTION:

Introduction to Geology and its importance in Civil Engineering practices. Internal structure and composition of the earth.

MINERALOGY:

Study of rock forming and economically important minerals. Physical properties, chemical composition, uses and contribution of the following minerals in preparation of construction materials - : Quartz and its varieties: Feldspar group: Mica Group: Carbonate group: Calcite, Asbestos, Kaolin and Garnet. Ore minerals: Hematite, Magnetite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena and Bauxite.

5 Hours

PETROLOGY:

Introduction, Rock cycle and study of the following Rocks.

IGNEOUS ROCKS:

Definition, origin, classification, and forms of Igneous Rocks. Texture structure, Petrological description and Engineering importance of the following rocks: Granite Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite and Basalt.

SEDIMENTARY ROCKS:

Definition, origin, classification of Sedimentary rocks. Primary structures Petrological description and engineering importance of the following Rocks. Conglomerate Breccia, Sand Stone, Shale, Limestone and Laterite.

METAMORPHIC ROCKS:

Definition, types of Metamorphism, Metamorphic structures. Petrological, description and Engineering importance of the following rocks. Slate, Schist, Gneiss, Quartzite, and Marble.Weathering and deterioration of rocks. Types and agents of weathering.

6 Hours

APPLIED GEOLOGY:

Selection of rocks for foundation, construction, cladding, flooring, concrete aggregate, road metal, and railway ballast with examples, Site selection for Dams, Reservoirs, and Tunnels. Silting up of reservoir and remedial measures.

GEODYNAMICS:

Dynamic activities of the Earth, Plate tectonics. Geological and Engineering considerations of Land slide, (mass movements) Avalanches causes and precautions. Earthquakes - seismic waves, seismic zones, causes and effects.

10 Hours

STRUCTURAL GEOLOGY (ROCK MECHANICS):

Introduction, Stress and Strain in rocks, Outcrop, Dip and Strike, and Compass clinometers. Study of structural features of rocks. Description of Folds, Faults and Joints, their identification in the field. Importance in various Civil Engineering projects.

5 Hours

HYDROGEOLOGY:

Introduction, Study of Groundwater and its importance, Occurrence of groundwater in different Geological rock formation, Water table, Water level fluctuation. Types of Aquifers- Confined and unconfined Aquifers, Artificial recharge of ground water. Selection of well sites, Geological and Geophysical Methods of Groundwater exploration and Applications of Electric resistivity method.

6 Hours

Lab components must comprise of experiments that reinforce the theoretical understanding of the corresponding theory subject. Outlines of the laboratory components should be mentioned by the respective staff members well before the commencement of the course.

TEXT BOOKS:

1. A Text of Engineering and General Geology, By Parbin Singh, 2009
2. A Text of Geology, by P.K. Mukherjee, 2006

REFERENCES:

1. A Text of Engineering and Geology, by B.S. Sathyanarayanaswamy
2. Physical Geology, By Arthur Homes
3. Principle of Engineering Geology, by KVGK Gokhale
4. Principle of Engineering Geology, by K.M. Bangar
5. Physical and Engineering Geology, by S.K. Garg
6. Geology for Engineers, By D.S. Arora
7. Engg Geology by S K, Duggalet. Al
8. Engineering Geology by D.Venkatareddy
9. Ground water Geology by Todd D.K. Jhon Willey and Sons, New York

LEARNING RESOURCES:

1. www.geoscienceworld.org
2. www.springer.com
3. http://en.wikipedia.org
4. www.gle.wisc.edu
5. www.geoexpro.com
6. http://freevideolectures.com/Course/87/Engineering-Geology

EXPERIMENTS/EXERCISES:

1. **MINEROLOGY: Study of Physical Properties of the mineral and their contribution in preparation of construction materials**
   - **Practical no. 1: Study of the Physical Properties of the following minerals**.
   - **Quartz group of Minerals:-** Rock crystal, Rose Quartz, Jasper banded Agate/Jasper, Smoky Quartz
   - **Feldspar Group:** Orthoclase, Plagioclase, Microcline.
   - **Mica Group:** Biotite Mica, Muscovite mica.
   - **Practical no. 2: Study of the Physical Properties of the following minerals.**
   - **Carbonate Group:** Calcite, Magnesite, Dolomite.
   - **Ferro-Magnesium Minerals:** Hornblende, Augite, Olivine, Asbestos, Talc, Garnet, Gypsum
   - **Practical no.3: Study of the Physical Properties of the following minerals**
   - **Ore Minerals:** Hematite, Magnetite, Limonite, Iron Pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena, Bauxite.

2. **PETROLOGY: Identification of Rocks Based on their Index Properties**
   - **Practical no.4: Igneous Rocks:** Granite, Diorite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite and Basalt.
   - **Practical no. 5: Sedimentary Rocks:** Conglomerate, Breccia, Sandstone, Shale, Limestone and Laterite.
   - **Practical no. 6: Metamorphic Rocks:** Slate, Schist, Gneiss, Quartzite, and Marble.

3. **STRUCTURAL GEOLOGY (ROCK MECHANICS):**
   - **Practical no. 7:** Analysis and understanding of the Lithological Character of sub surface by Vertical Electrical Sounding (VES) resistivity method.
   - **Practical no. 8:** Dip and Strike Problems (two types).
   - **Practical no. 9:** Borewell Problems on level Ground (two types).
   - **Practical no. 10:** Study and Interpretation of Standard Structural Geological Maps.

III SEMESTER CIVIL ENGINEERING

Course Name	**Basic Surveying**	Course Code	**15CV3DCBSY**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**2-0-1-2**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable the students to gain knowledge in the basics of surveying and instrumentation connected with it. This enables for the understanding of the infrastructure projects.

COURSE OUTCOMES

CO1: Explain the importance and principle of surveying, different types of surveys and techniques used in surveying.

CO2: Apply different methods used for linear and angular measurements, and calculate the elevation of objects.

CO3: Explain working principle and usage of different types of modern surveying instruments.

INTRODUCTION

Definition of surveying. Historical perspective of surveying. Comparison between geometry and surveying. Necessity of surveying. Plan and maps. Classification of surveying. Basic geometrical relations used for understanding surveying. Basic measurements. Control surveys –Horizontal and vertical. Cardinal principles of surveying. Error, Accuracy and precision. Numerical problems on precision and accuracy. Map & Classification. Survey of India topographical Maps and their numbering.

5 Hours

THEODOLITE SURVEYING

Essentials of transit Theodolite, Definitions and terms, Temporary and permanent adjustments, Measurement of horizontal and vertical angles, Fundamental lines and desired relations, Sources of error in Theodolite.

5 Hours

TRIGONOMETRIC LEVELLING

Introduction, Base of the object accessible, Base of the object inaccessible: instruments stations in same and different vertical plane, Determination of height of an elevated object, Determination of height of an elevated object from three different stations, Numerical problems.

5 Hours

TACHEOMETRIC SURVEYING

Different types, Principles, Distance and elevation formulae for different conditions, Horizontal base substense measurements, Special instruments, Errors in stadia surveying, Numerical problems.

4 Hours

LEVELLING

Concepts of levelling, instruments used. Terms and definitions. Reductions of level, Booking of levels, Classification of levelling. Curvature and refraction effects, Reciprocal levelling, Errors. Numerical examples on booking and reduction of levels, calculation of gradients, correction for curvature and refraction, true difference in height using reciprocal observations. Contouring, characteristics and applications.

5 Hours

INSTRUMENTATION IN SURVEYING

Electronic Theodolites, Autolevel, Geodimeter, Tellurometer, Distomats, Total Station.

2 Hours

TEXT BOOKS:

1. Punmia. B.C., Ashok. K. Jain and Arun .K. Jain ‘Surveying Vol1, Lakshmi Publications, 2014.
2. Roy. S.K., Fundamentals of Surveying’ Prentice Hall of India, 1999, New Delhi.
3. Duggal. S.K, ‘Surveying’ Volume 1, Tata McGraw Hill, 1996, New Delhi.

REFERENCE BOOKS:

1. Kavanagh, Barry F. Surveying: Principles and Applications, 8th Edition, 2009, Prentice Hall.
2. Arthur Bannister, Stanley Raymond and Raymond Baker. Surveying, 7th Edition, Pearson Education

EXPERIMENTS/EXERCISES

1. Study of various instruments used for surveying, namely chain, tape, Compass, Dumpy level, Autolevel, Theodolite, Tacheometer, Total station and GPS
2. Study of topographic maps and preparation of a chart of conventional symbols used in toposheets.
3. To set regular geometric figures using linear measuring instruments and accessories
4. Study of prismatic compass and finding the fore bearing and back bearing of a given survey line.
5. To set regular geometric figures using prismatic compass, given the bearing of one line.
6. To find the distance between two inaccessible points using prismatic compass, chain, tape and other accessories.
7. Study of use of Dumpy level. To determine the reduced level of various points using Dumpy level.
8. To find the true difference in elevation between two points situated far apart by using reciprocal leveling.
9. To conduct profile leveling & cross-sectioning and to plot the details.
10. Leveling exercises by using Total-stations.

III SEMESTER CIVIL ENGINEERING

Course Name	**Mechanics of Fluids**	Course Code	**15CV3DCMOF**	SEE Duration	SEE+CIE
Credits	**04**	L-T-P-S	**3-1-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

- To introduce the basic concepts of fluid mechanics
- To introduce the pressure concepts, types, its determination.
- To introduce the basic concepts of fluid kinematics and fluid kinetics, their applications to civil engineering problems.
- To introduce the basic laws of fluid dynamics and their applications.

COURSE OUTCOMES:

CO1: Explain the mechanics of fluids at rest and in motion by describing and observing the fluid phenomena

CO2: Analyse fluid interactions with natural and constructed systems using the principles and laws of fluid mechanics

CO3: Apply knowledge for subsequent courses involving the analysis & design of flow related systems

INTRODUCTION:

Definition of fluid, Distinction between Solid, fluid & gases, Concept of Fluid Continuum

Fluid Properties: Mass Density, Specific Volume, Specific Weight, Specific Gravity- Definitions, Units and Dimensions, Viscosity, Newton's Law of Viscosity, Newtonian & Non-Newtonian Fluids, Ideal & Real Fluids, Compressibility, Vapor Pressure, Surface Tension, and Capillary.

4 Hours

FLUID PRESSURE & ITS MEASUREMENT:

Definition of Pressure, Pressure at a point in a static fluid, Hydrostatic pressure law, Types of Pressures, Measurement of Pressure- Simple & Differential Manometers and Mechanical Gauge.

7 Hours

HYDROSTATICS:

Definition of Total Pressure, centre of pressure, Total pressure & centre of pressure on Vertical plane surface, Inclined & curved plane surfaces. Pressure Diagram. Practical applications- Dams & Gates.

10 Hours

KINEMATICS OF FLUID:

Description, Continuity Equation in differential form, Velocity Potential, Stream Potential, Equipotential line, Line of constant stream line, Flow net.

Classification of fluid flow, Stream line, Streak Line, Path Line, Stream tube, Acceleration of Flow in one dimensional flow, types of accelerations. **10 Hours**

DYNAMICS OF FLUID FLOW:

Concept of Inertia force and other forces causing Motion, Derivation of Euler's & Bernoulli's Equation (Both for Ideal & Real Fluids),

Applications of Bernoulli's Equation- Venturi Meter, orifice Meter & Pitot Tube Theory. Flow through Orifices and mouth pieces, Flow over Notches and weirs. **10 Hours**

PIPE FLOW SYSTEMS:

Energy losses in pipes- introduction, Darcy- Weisbach equation, Moody diagram, Energy losses in pipe lines- minor losses, multiple pipe systems. Water Hammer in Pipes: Definition, Equation for pressure rise due to gradual closure of valve, sudden closure in rigid & plastic pipes, problems, surge tanks, types & functions **5 Hours**

Boundary layer theory and applications- concept of boundary layer and its growth.

Dimensional Analysis Introduction, Dimension, Dimensional homogeneity, Methods- Rayleigh method, Buckingham Pi method, Similitude- Geometric, Kinematic & Dynamic Similarity

6 Hours

TEXT BOOKS:

1. Fluid Mechanics including Fluid Machines– P.N.Modi & S.M.Seth, Standard Book House, New Delhi, 20th Edition, 2015

REFERENCE BOOKS:

1. Fluid Mechanics- Victor L Streeter & E. Benjamin Wylie, McGraw Hill Publications.
2. Fluid Mechanics- Frank M White, Sixth Edition, the McGraw Hill Companies.
3. Fundamentals of Fluid Mechanics- Bruce R Munson & Donald F Young, John Wiley & Sons, Inc.
4. Fluid Mechanics- K.L. Kumar, S. Chand & Company Ltd, New Delhi.
5. Fluid Mechanics & machinery – C.S.P. Ojha, R. Berndtsson & P.N. Chandramouli, Oxford University Press.
6. Fluid Mechanics- R.K. Bansal, Laxmi Publications, New Delhi.

E-Books / Resources

http://nptel.ac.in/courses/105101082/
http://elearning.vtu.ac.in/10CV35.html

Course Name	**Strength of Materials**	Course Code	**15CV3DCSOM**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**3-1-1-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

After having learnt the mechanism of force transference, it is essential to know the response of the material/structure under different configuration of loading. The objectives of the course are to enable students to identify different materials and their response to loadings in terms of stresses, strains, bending moment and shear force.

COURSE OUTCOMES:

CO1: Explain stress and strain at a point and their relations in a deformable material

CO2: Apply the force equilibrium conditions and the concept of free body diagrams to determine structural responses

SIMPLE STRESSES AND STRAINS:

Introduction, Properties of Materials, Stress, Strain, Hooke's law, St. Venant`s principle, Stress–Strain Diagram for structural steel and nonferrous materials, Principles of superposition, Deformation of uniform bars, bars of varying cross ections,taperingbarsofcircularandrectangularcrosssections.Deformationduetoself–weight.

8 Hours

ELASTIC CONSTANTS:

Relationship among elastic constants, volumetric strain, Stresses in composite sections Thermal stresses (including thermal stresses in compound bars).

TRANSFORMATION OF STRESSES: Introduction, Resolution of stresses on inclined planes, General two dimensional stress system, Principal planes and Principle stresses, Plane stress and plane strain conditions, Mohr's circle of stresses

8 Hours

BENDING MOMENT AND SHEAR FORCE IN BEAMS:

Introduction, Definitions-Bending moment and Shearing force in beam, Sign convention, Relationship between loading, shear force and bending moment, SFD and BMD with salient values for statically determinate beams(cantilever Beams, simply supported beams and overhanging beams) subjected to point loads, UDL, UVL and Couple.

BENDING STRESS IN BEAMS: Introduction – Bending stress in beam, Assumptions in simple bending theory, Pure bending derivation of Bernoulli's equation, Modulus of rupture, section modulus, flexural rigidity, Variation of bending stresses across the cross section of the beams

SHEAR STRESS IN BEAMS: Expression for horizontal shear stress in beam, Shear stress diagram for rectangular, symmetrical 'I' and 'T' section (Flitched beams not included).

12 Hours

ELASTIC STABILITY OF COLUMNS: Introduction–Short and long columns, Assumptions, Euler's theory on columns, Derivation of Euler's buckling load for a column with both ends hinged Effective length slenderness ratio, radius of gyration., Limitations of Euler's theory, Rankine's formula and problems.

12 Hours

TORSION OF CIRCULAR SHAFTS:

Pure torsion, torsion equation of circular shafts, Strength and stiffness, Torsional Rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections.

THIN AND THICK CYLINDERS: Stresses in thin cylinder subjected to pressure, hoop, longitudinal and volumetric strains, Thick cylinders-Lame's equations, radial and hoop stresses (excluding compound cylinders).

6 Hours

TEXT BOOKS:

1. Mechanics of Materials by Ferdinand P. Beer and E. Russel Johnston(jr)Publisher, 6th Edition, 2013
2. Strength of materials by L.S.Srinath, Prakash Desai and Ananth Ramu Publisher, 2nd Edition, 2009

REFERENCE BOOKS:

1. Elements of Strength of Materials, Timoshenko and Young, Affliated East-West Press.
2. Mechanics of Materials, James M. Gere (5thEdition),Thomson Learning.
3. Strength of materials By I.B.Prasad, Khanna Publisher

LEARNING RESOURCES: NPTEL

EXPERIMENTS/EXERCISES:

1. Physical properties of Bricks and Blocks – Dimensionality, water absorption, density and Compressive strength
2. Impact test on Mild Steel (Charpy & Izod)
3. Hardness tests on ferrous and non-ferrous metals – Brinell's, Rockwell and Vicker's
4. Tension test on Mild steel and HYSD bars.
5. Compression test of Mild Steel, Cast iron and Wood
6. Torsion test on Mild Steel circular sections
7. Bending Test on Wood and Mild steel
8. Shear Test on Mild steel

Semester: IV (2015 onwards)

Course Code	Course Title	Teaching Dept.	Credits				Total Credits	Contact Hours	CIE MARKS	SEE MARKS	TOTAL MARKS
			L	T	P	S					
15MA4GCMAT	Maths (BS)	MATHS	3		-	-	3	3	50	50	100
15CV4DCSTA	Structural Analysis (ES)	CIVIL	3	1	-	-	4	5	50	50	100
15CV4DCCON	Concrete Technology (ES)	CIVIL	2	-	1	2	5	4	50	50	100
15CV4DCASY	Advanced Surveying (ES)	CIVIL	2	-	1	-	3	4	50	50	100
15CV4DCSME	Soil Mechanics (ES)	CIVIL	2	1	-	-	3	4	50	50	100
15CV4DCHYM	Hydraulics & Hydraulic Machines (ES)	CIVIL	2	-	1	-	3	4	50	50	100
15CV4DCBPD	Building Planning & Drawing (ES)	CIVIL	1	-	1	2	4	4	50	50	100
			Total Credits			4	**25**	28			**700**

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

IV SEMESTER CIVIL ENGINEERING

Course Name	**Engineering Maths-IV**	Course Code	**15MA4GCMAT**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**3-0-0-0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To prepare students with adequate knowledge in Probability and Statistics, Complex Analysis

COURSE OUTCOMES:

CO1: Calculate solutions of algebraic and transcendental equations, ordinary differential equations numerically

CO2: Compute solution of one dimensional heat and wave equation using finite difference techniques.

CO3: Construct analytic functions and evaluate real and complex integrals.

CO5: Estimate the relation between two variables and perform regression analysis.

CO6: Apply the basic principles of probability and probability distributions.

NUMERICAL METHODS:

Solution of algebraic and transcendental equations: Newton-Raphson method. Finite Differences and interpolation: Forward differences, backward differences. Newton-Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Lagrange's interpolation formula, Lagrange's inverse interpolation.

Numerical integration: Simpson's $1/3^{rd}$, $3/8^{th}$ rule, Weddle's rule.

Numerical solution of ordinary differential equations: Euler's modified method, Runge-Kutta method of fourth order.

Suggested Reading: Solution of simultaneous differential equations by Picard's method, Milne's method to solve ordinary differential equations

7 Hours

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS:

Finite-Difference formulas to partial derivatives.

Applications: Solution of one-dimensional heat equation using 2-level formula and Schmidt explicit formula and Crank-Nicolson two-level implicit formula Solution of one-dimensional wave equation using explicit three level formula.

8 Hours

IV SEMESTER CIVIL ENGINEERING

COMPLEX ANALYSIS-1:

Function of a complex variable, limits, continuity and differentiability of a complex valued function, Analytic functions, properties of analytic functions, Cauchy-Riemann equations in cartesian and polar form, construction of analytic functions by Milne-Thomson method, Conformal mapping-Transformations- $w = z^2$ and $w = z + \frac{a^2}{z} \quad z \neq 0$, Bilinear transformations.

Suggested Reading: Standard transformations $w = c + z,\ w = cz,\ w = 1/z$, properties of bilinear transformations

7 Hours

COMPLEX ANALYSIS-2:

Line integral, Problems on line integral, Cauchy's theorem, Cauchy's integral formula.

Taylor's, Maclaurin's and Laurent's series (without proof).Poles, Residues, Residue theorem (without proof).Evaluation of real definite integrals using residues - Integration around a unit circle and semicircle

Suggested Reading: Removable and essential singularities, improper real integrals with singular points on real axis.

7 Hours

STATISTICS AND PROBABILITY:

Curve fitting – Principle of least squares, fitting a straight line, fitting of a parabola, fitting of exponential curves of the form $y = a\ b^x,\ \ y = ae^{bx}$. Correlation and regression.

Probability distributions: Discrete distribution - Poisson distribution. Continuous distribution-normal distribution.

Suggested Reading: Fitting the curve $y = a\ x^b$, exponential distribution and uniform distribution

7 Hours

TEXT BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, 2007, Wiley-India
2. Higher Engineering Mathematics, B.S. Grewal, 40th edition, 2007, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
3. Advanced Engineering Mathematics, P. V. O' Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
4. Introductory methods of Numerical Analysis, S. S. Sastry, 3rd edition, 1999, Prentice-Hall of India.

BMS COLLEGE OF ENGINEERING, BANGALORE-560 019
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IV SEMESTER CIVIL ENGINEERING

Course Name	**Structural Analysis**	Course Code	**15CV4DCSTA**	SEE Duration	SEE+CIE
Credits	**04**	L-T-P-S	**3:1:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable the students to gain knowledge on the fundamentals of structural analysis by applying the knowledge gained through Engineering Mechanics and Strength of Materials. It enables to get the prerequisite for advanced analysis and design of structures.

COURSE OUTCOMES:

CO1: Identify forms of structures and the associated indeterminacies

CO2: Apply the force equilibrium conditions and compatibility conditions to analyze simple structures like arches, cables and evaluate structural resultants.

CO3: Apply energy principles to analyze and evaluate simple determinate structures.

Introduction to Structural Systems-Classification of structures, Structural forms, Loads, Conditions of equilibrium, Compatibility conditions, Statically determinate and indeterminate structures, degree of Static and Kinematic indeterminacy.

Analysis of Cables and Three Hinged Arches - Types of Arches, Analysis of Three hinged arches (Parabolic and Circular) with supports both at same and at different levels. Analysis of cables under point loads and UDL (supports at same level and different level)

12 Hours

Deflection of Beams- Macaulay’s double integration method, Conjugate beam method and moment area method.

Consistent Deformation method; Analysis of Propped cantilever and fixed beams.

Analysis of Continuous beams: Clapeyron’s theorem of three moments.

20 Hours

Strain Energy Principle-Strain energy and complimentary strain energy. Strain energy due to axial load, bending moment and shear force. Theorem of minimum potential energy, principle of virtual work. Castigliano's theorems and their applications in the analysis of beams and trusses. Maxwell – Betti theorem of reciprocal deflection.

6 Hours

Deflection of beams and trusses by Unit load method. Redundant Trusses- Analysis by unit load method. **10 Hours**

TEXT BOOKS:

1. Theory of Structures Vol-1 by Pandit and Gupta, Tata McGraw Hill, New Delhi, 1st Edition
2. Basic Structural Analysis by C S Reddy, Tata McGraw Hill, New Delhi, 3rd Edition

REFERENCE BOOKS:

1. Elementary Structural analysis, Norris and Wilbur, International student edition, Tata McGraw Hill book Co, New York.
2. Structural Analysis by R C Hibler, 5th edition, Pearson Education Inc.

Learning Resources: NPTEL

IV SEMESTER CIVIL ENGINEERING

Course Name	**CONCRETE TECHNOLOGY**	Course Code	**15CV4DCCON**	SEE Duration	SEE+CIE
Credits	**05**	L-T-P-S	**2-0-1-2**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable students to have the knowledge on the ingredients for concrete preparation, properties of concrete and the testing of concrete properties in accordance with the IS codes.

COURSE OUTCOMES:

CO1: Apply the fundamental principles and procedures in making concrete

CO2: Apply basic requirements of the IS design specifications for designing concrete mixes

CO3: Assess the deterioration of concrete and test methods

CO4: Recognize the characteristics of special types of concrete

CONCRETE INGREDIENTS:

Hydraulic Cements: Manufacturing process, Chemical composition, types of cement, hydration of cement, micro structural development of Portland cement, testing of cement

Aggregates: Properties, types of aggregates, classification of aggregates, importance of grading, specific gravity, bulking, moisture content, deleterious materials, testing of aggregates, interfacial transition zone, recycled aggregates.

Water: qualities of water, use of sea water Chemical admixtures: water reducers, accelerators retarders and air entraining admixture Mineral additives; fly ash, slag, silica fume, rice husk ash, metakaolin and limestone powder

FRESH CONCRETE AND CONCRETE PRODUCTION:

Properties of fresh concrete; Workability, Factor affecting workability, measurement of workability, slump, compacting factor, Vee-Bee consistometer and flow tests, Segregation and bleeding, shrinkage, Rheology of fresh concrete, its importance and Bingham parameters Process of manufacture of concrete: Batching, mixing, transportation, placing and compaction and curing by different methods

MIX PROPORTIONING OF CONCRETE:

Concrete mix design: Concept of mix design, role of water to cement ratio, water content, other variables and exposure conditions, IS method, ACI method, numerical problems, concept of particle packing and rheology based method of mix design

HARDENED PROPERTIES AND DURABILITY OF CONCRETE:

Engineering properties of concrete; Compressive strength and the factors affecting the strength, tensile strength, bond strength, modulus of rupture, Elasticity, factors affecting modulus of elasticity, poisons ratio, creep, provisions of IS 456 in quality control

Durability: Significance of durability, mass transport in concrete, carbonation, chloride ingress Sulphate attack, freezing and thawing

IN-SITU TESTING AND SPECIAL CONCRETES:

Non–destructive testing; rebound hammer, ultrasonic pulse velocity, penetration and pull out test, principle, applications and limitations, core extraction

Special concretes; Introduction to fibre reinforced concrete, high strength concrete, self-compacting concrete, geo polymer concrete and ready mix concrete,

TEXT BOOK:

- Properties of Concrete - A M Neville (Pearson Education Asia Pvt ltd,), Four Edition

REFERENCE BOOKS:

- Concrete –microstructure,properties and materials –PK Mehta and paulo JM Monteiro (ICI)
- Concrete Technology - A R Santhakumar (Oxford –New Delhi)
- Concrete Technology - Gambhir ML(Tata McGrawHill)
- Concrete Mix Design - N Krishna raju
- Concrete Technology Theory and Practice - MS Shetty(S Chand and company)
- Relevant codes
- Current literature

EXPERIMENTS/ EXERCISES

Tests on Fine Aggregate:

1. Specific Gravity Test
2. Sieve analysis
3. Bulking of fine aggregate
4. Unit weight % Voids

Tests on Coarse Aggregate:

1. Specific Gravity & Water absorption test
2. Sieve analysis
3. Unit weight

Tests on Cement:

1. Consistency test on cement
2. Setting time test on cermet
3. Specific gravity test
4. Fineness of cement
5. Compressive strength of cement

Tests on fresh concrete:

1. Slump test
2. Compaction factor test
3. Vee-Bee Consistometer test
4. Flow table test

Tests on hardened concrete

1. Compressive strength of concrete cube
2. Compressive strength of Cylinder
3. Split tensile strength
4. Flexural strength of concrete beam

NDT tests

1. Pulse ultrasonic test
2. Rebound Hammer test.

IV SEMESTER CIVIL ENGINEERING

Course Name	**Advanced Surveying**	Course Code	**15CV4DCASY**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:0:1:0**	**3Hours**	**50+50**

OBJECTIVES:

To enable the students to gain knowledge in the advancements of Surveying, which enables the student in a faster decision making process

COURSE OUTCOMES:

CO1: Apply fundamental principles and procedures for curve setting.

CO2: Recognize the characteristics of Triangulation.

CO3: Describe the functional components of field astronomy.

CO4: Recognize the basics of Photogrammetry Remote sensing and GIS

CURVE SETTING:

Simple Circular Curves, Elements, Setting out two theodolite method; Compound and Reverse curve, Elements, Relationship between various parts of reverse curve; Transition curve, elements, computation and setting out; Vertical curves computation and setting out.

6 Hours

TRIANGULATION:

Geodesic Surveying, Classification, Signals and towers, Base line masurement, Computations.

4 Hours

FIELD ASTRONOMY:

Definitions, Co-ordinate system, Astronomical triangle, Units of time, Determination of co-ordinates, Observations for time, Determination of Azimuth, Determination of Latitude and Longitude.

4 Hours

PHOTOGRAMMETRY:

Introduction – Basic Principles- Photo theodolites - Definitions – Horizontal and Vertical angle from teerestial photography – Horizontal position of a point from photo graphicmeasurement from camera horizontal axis - Elevation of point by photographic measurement – Focal length, Basics of Aerial Surveying.

4 Hours

REMOTE SENSING:

Introduction – Historical sketch of Remote Sensing - Idealized remote sensing – Basic principles of remote sensing – Electromagnetic energy electromagnetic spectrum – Wave length regions and their application in remote sensing – characteristics of solar radiation – Basic radiation law – EM radiation and atmosphere –Interaction of EM radiation with earth surface –remote sensing observation platform – sensors – applications.

4 Hours

GEOGRAPHIC INFORMATION SYSTEMS (GIS):

Definitions: The four M's concept – contributing disciplines for GIS, GIS objectives – components of a GIS –Topology –Data structures –Data base management –Errors in GIS –GIS software package –Linkage of GIS to remote sensing –application areas of GIS and Remote sensing; GIS concepts and spatial models; Spatial information, temporal information, conceptual models of spatial information, representation of geographic information, Data management.

4 Hours

TEXT BOOKS:

1. Kavanagh, Barry F. Surveying: Principles and Applications, Vol-2, 8th Edition, 2009, Prentice Hall.
2. Remote Sensing and Image Interpretation – Lille Sand, John Wiley and Sons, 7th Edition, 2015
3. Elements of Photogrammetry – Paul R Wolf, McGraw International, 4th Edition, 2014

REFERENCES BOOKS:

1. Principles of GIS –Peter A Burrough, Oxford Publications
2. GIS and Computer Cartography –Christopher Jones, Longman Publications
3. GIS –Bemhardsen, Wiley Publications.
4. Surveying- Vol. II – B.C. Punmia, Ashok K. Jain, Laxmi Publications.
5. Remote Sensing and GIS – M Anji Reddy.
6. Arthur Bannister, Stanley Raymond and Raymond Baker. Surveying, Vol.2, 7th Edition, Pearson Education.

EXPERIMENTS/EXERCISES:

1. Setting out a Simple Curve.
2. Setting out a Compound curve.
3. Setting out a Reverse Curve.
4. Setting out a Transition curve.
5. Setting out Bernoulli's lemniscate curve.
6. Triangulation: Baseline measurement.
7. Tracing contours.
8. Satellite stations reduction to centre.
9. GPS Survey.
10. Field Astronomy: Determination of latitude and longitude.
11. Remote Sensing: Digitization of an image.
12. GIS – Basics of data storage.

Course Name	**Soil Mechanics**	Course Code	**15CV4DCSME**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:1:0:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To provide the basic principles and to understand the engineering behaviour of soil to address practical problems in soil mechanics.

COURSE OUTCOME:

CO1: Evaluate index properties of soils, analyze and interpret the experimental data to classify and identify soil.

CO2: Describe structure of soils, soil water systems and evaluate effective stresses in soils.

CO3: Explain the concepts and evaluate permeability, compaction characteristics and shear parameters of soil.

INTRODUCTION:

Definition, origin and formation of soil. Agents causing formation of soils. List of different soil types. Definition of mass, weight. Relation between mass and weight. Units of mass and weight in SI units. Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their interrelationships , Numerical problems

8 Hours

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION:

Index Properties of soils and their significance. Various index properties and their Laboratory determination, -Water content, Specific Gravity, Particle size distribution (Sieve analysis and Hydrometer analysis), Relative density, Consistency limits and their indices, in-situ density, Activity of Clay, Thixotropy of clay, IS classification; - Plasticity chart and its importance, Field identification of soils. Numerical problems

10 Hours

CLAY MINERALOGY AND SOIL STRUCTURE:

Single grained honey-combed, flocculent and dispersed structures, Types of soil-Water, base-exchange capacity, Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

Effective Stress: Effective stress concept-Total pressure and Porepressure, effect of water table, Numerical problems

6 Hours

FLOW OF WATER THROUGH SOILS-I:

Darcy's law- Assumption and validity, coefficient of permeability and its Laboratory determination, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, Numerical problems

Compaction of soils: Definition, Principle of compaction. Standard and Modified Proctor's tests and their compactive energy. Factors affecting compaction, Field compaction control, Numerical problems

8 Hours

SHEAR STRENGTH OF SOILS:

Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, factors affecting shear strength of soils, conventional failure envelope. Total and effective shear strength parameters, Sensitivity of clay. Measurement of shear parameters-Direct shear test, unconfined compression test, and, Tri-axial shear test., Types of drainage conditions,

8 Hours

TEXT BOOKS

1. Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi,

REFERENCE BOOKS:

1. Punmia B.C. (2005), "Soil Mechanics and Foundation Engg.", 16th Edition, Laxmi Publications Co. , New Delhi.
2. Head K.H., (1986), "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London.

3. Braja, M. Das (2002), "Principles of Geotechnical Engineering", Fifth Edition, Thomson Asia Pte Ltd.,
4. Craig R.F. (2004), "Soil Mechanics", 7th edition, Spon press, New York.
5. GopalRanjan and Rao A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.
6. Lambe and Whitman (1979), "Soil Mechanics" John Wiley & Sons, New York
7. Terzaghi. K., and Peck. R.B. (1967) "Soil mechanics in Engineering practice", 2nd Edition, John Wiley and Sons, New York.
8. Relevant B.I.S codes

E-BOOKS

1. http://www.myopencourses.com/subject/e-book-on-concepts-and-techniques-in-geotechnical-and-foundation-engineering
2. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv104-Page1.htm
3. nptel.ac.in/courses/105101084/
4. https://ay14-15.moodle.wisc.edu/prod/course/view.php?id=499

IV SEMESTER CIVIL ENGINEERING

Course Name	**Hydraulics & Hydraulics Mechanics**	Course Code	**15CV4DCHYM**	SEE Duration	SEE+CIE
Credits	**03**	L-T-P-S	**2:0:1:0**	**3 Hours**	**50+50**

COURSE OBJECTIVES:

To enable the students to gain knowledge in understanding the fundamentals of hydraulics and functioning of hydraulic machine. Expose the students to experimental techniques in hydraulics and evaluations of hydraulic machines.

COURSE OUTCOME:

CO1: Understand and analyse the Uniform & Non Uniform Flows in open channels.

CO2: Understand Impulse Momentum Equation and its applications & carry out computations on impact of jet on fixed, moving plates.

CO3: Understand the working of pumps and turbines and study the performance of these machines.

CO4: Understand the dimensional analysis and apply it in the design of prototypes.

FLOW IN OPEN CHANNELS: Definition of channel, difference between pipe and open channel flow, classification, types of flows, geometric properties of open channels.

2 Hours

Uniform flow in open channels, Chezy's & Manning's formula, Most economical open sections-rectangular, trapezoidal, circular sections- derivations. Specific Energy, definitions, Specific Energy curve, condition for Maximum discharge & Minimum specific energy, critical flow in rectangular sections.

4 Hours

FLOW IN OPEN CHANNELS (NON-UNIFORM FLOW): Definition, Types of Non- Uniform flows, Gradually Varied flow- derivation & Problems, Classification of channel bottom slopes, hydraulic jump, hydraulic jump in a rectangular channel, types & applications.

5 Hours

IMPACT OF JET ON VANES: Introduction to impulse momentum equation, Force exerted by a jet of water on fixed and moving plates- Vertical, inclined, symmetrical and unsymmetrical curved plates, series of curved vanes, velocity triangles, work done & efficiency

5 Hours

TURBINES: Definition, classification, Pelton turbine, theory, equation for work done and efficiency, problems, Francis turbine, Kaplan turbine, theory, equation for work done and efficiency, Specific speed, unit quantities, characteristic curves.

5 Hours

PUMPS: Definition, classification general principle, priming, work done, minimum starting speed

5 Hours

TEXT BOOKS:

1. Hydraulics & Fluid Mechanics – P.N. Modi & S.M. Seth, Standard Book House, New Delhi, 20th Edition, 2015

REFERENCE BOOKS:

1. Experimental Fluid Mechanics - Asawa,G.L., Vol.1, Nem Chand and Bros.,
2. Flow through Open Channels , Subramanya K, TMH Publications
3. Fluid Mechanics- R.K. Bansal, Laxmi Publications, New Delhi.
4. Fluid Mechanics- K.L. Kumar, S. Chand & Company Ltd, New Delhi.
5. Fluid Mechanics through Problems- Garde,R.J., New Age International Publications, New Delhi.
6. Flow through open channels- Ranga Raju, K.G., T.M.H. 2nd edition
7. Open Channel Hydraulics- V.T. Chow, Mc-Graw Hill Publications.

E-Books

http://nptel.ac.in/courses/105103096

http://nptel.ac.in/courses/105107059/

http://elearning.vtu.ac.in/P6/enotes/CV44/Flw_OpenCh-NB.pdf

EXPERIMENTS/EXERCISES:

1. Hydrostatic Bench
2. Reynold's Apparatus
3. Heale Shaw Apparatus
4. Pressure drop in a Venturi meter
5. Friction in pipes
6. Coefficient of discharge of an Orifice & Mouth Piece
7. Coefficient of discharge of a V- Notch
8. Coefficient of discharge of an oghee weir & a Rectangular notch
9. Coefficient of discharge of a Venturimeter
10. Study the impact of jets on vanes
11. Study on hydraulic jump
12. Centrifugal pump and turbines

IV SEMESTER CIVIL ENGINEERING

Course Name	**Building Planning & Drawing**	Course Code	**15CV4DCBPD**	SEE Duration	SEE+CIE
Credits	**04**	L-T-P-S	**1:0:1:2**	**4 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:

CO1: Prepare drawings of components of a building.

CO2: Design and prepare functional drawings for buildings as per norms.

CO3: Develop drawings showing the interconnectivity of functional components of buildings along with service layouts.

Guidelines for building drawings, Scales, definition of terms used in building drawings. To prepare geometrical drawing of component of buildings i) Stepped wall footing and isolated RCC column footing, ii) RCC dog legged stairs, iii) Doors & windows (Fully paneled door & glazed window), iv) Truss (Wooden & steel)

15 Hours

Specification for residential and public building, bye laws, setback distances and calculation of carpet area, plinth area and floor area ratio.

Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram of public buildings (Primary Health Centre, office building, school building).

12 Hours

For a given single line diagram, preparation of water supply, sanitary and electrical layouts,

6 Hours

Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings, i) Two bed room single storey building, ii) Two storeyed building (Only for Practice)

15 Hours

Text Books:

1. **"Building Drawing"**, by Shah M. H. And Kale C. M., Tata McGraw Hill Publishing Co. 2002

REFERENCE BOOKS:

2. **"A Course in Civil Engineering Drawing"**, by V. B. Sikka, S. K.Kataria & Sons.
3. **"Building Construction"**, Gurucharan Sing, Standard publication
4. **IS:962-** Code of practice for architecture and building drawing National Building code, BIS, New Delhi

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				**25**	**26**			**700**

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

BMS COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

SCHEME OF TEACHING AND EXAMINATION 2016-2017

V SEMESTER B.E

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 ≤ 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 ≤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 ≤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/-**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.
5
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. 0**2 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 0**5 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 0**5 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. 0**6Hours**

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**

<u>Course objective</u>:

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

<u>Consolidation of Soils:</u> 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**

<u>Lateral Earth Pressure</u>: 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", 4th 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 2nd edition, New Age International (P) Ltd., New Delhi.
5. Head K.H., (2006), "Manual of Soil Laboratory Testing", 3rd 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", 3rd Edition, Wiley India Pvt Ltd, New Delhi.
8. Relevant B.I.S codes, ASTM and BS codes.

E Learning resources:

1)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

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

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, Constitute equation for measuring the rheological properties and the measuring instruments.

Fiber Reinforced Concrete: Fibers, types, characterstics, 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

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

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

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

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
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 sahni, Alka Dhameja, Uma Medury, “Disaster mitigation experiences and reflection”, PHI

V SEM CIVIL ENGINEERING
DEPARTMENT ELECTIVE
GLOBAL WARMING AND CLIMATE CHANGE

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

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 Charcterestics 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 Clmate change : Change of Temperature in the environmen-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.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous College under VTU)

DEPARTMENT OF

CIVIL ENGINEERING

SCHEME & SYLLABUS

FOR AUTONOMOUS COURSE

M.TECH.

Construction Technology

I to IV SEMESTER

(Admission Year: 2016 onwards)

BMS COLLEGE OF ENGINEERING

Bull Temple Road, Bengaluru - 560 019

B.M.S COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous College under VTU)

DEPARTMENT OF CIVIL ENGINEERING
VISION OF INSTITUTE

Promoting prosperity of mankind by augmenting human resource capital through Quality Technical Education & Training

MISSION OF INSTITUTE

Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society.

VISION OF THE DEPARTMENT

To be an excellent center for imparting quality higher education in Civil Engineering for a constantly changing societal needs with credibility, integrity and ethical standards.

MISSION OF THE DEPARTMENT

Accomplish excellence in curricular, co-curricular activities with a committed faculty through teaching and research which creates technically competent and dedicated civil engineers to serve their surroundings with pride.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

PEO1: Able to pursue professional career in the constantly changing field of construction, Engineering, Technology and Management.

PEO2: Able to contribute to knowledge base through teaching and research.

PEO3: Able to practice and promote sustainable construction technologies for social needs.

Programme Outcomes (POs):

Graduates Attributes(GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The GAs of PG programmes are examples of the attributes expected from a graduate of an accredited programme. The Graduate Attributes of PG programmes of the NBA are as following:

1.Scholarship of Knowledge:

Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.

2. Critical Thinking

Analyse complex engineering problems critically, apply independent judgment for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

3. Problem Solving

Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

4. Research Skill

Extract in formation pertinent to un-familiar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of Engineering.

5. Usage of modern tools

Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

6. Collaborative and Multi disciplinary work

Possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and team work, decision-making based on openmindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

7. Project Management and Finance

Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multi disciplinary environments after consideration of economical and financial factors.

8. Communication

Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

9. Life-long Learning

Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

10. Ethical Practices and Social Responsibility

Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research out comes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

11. Independent and Reflective Learning

Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

Percentage Credit Distribution

Sl. No.	Subject area	Percentage distribution of credits
1	Core Courses	30
2	Elective Courses	20
3	Seminar	02
4	Internship	21
5	Major Project	27

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Autonomous Institute Affiliated to VTU

DEPARTMENT OF CIVIL ENGINEERING

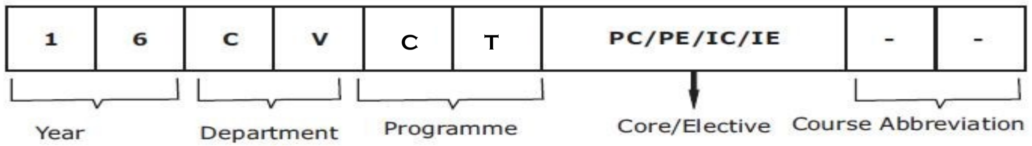
M.Tech.- Construction Technology- Scheme- 2016-17

I Semester

Course Code										Course Title	Credits					Contact Hrs/Wk
											L	T	P	S	Total	
1	6	C	V	C	T	P	C	M	C	Mechanization In Construction	3	-	-	1	4	3
1	6	C	V	C	T	P	C	P	M	Construction Project Management	3	-	1	-	4	5
1	6	C	V	C	T	P	C	C	M	Advances in Construction Materials	3	-	1	1	5	5
1	6	C	V	C	T	P	C	S	M	Structural Masonry	3	-	1	-	4	5
1	6	C	V	C	T	P	E	x	x	Elective–I	-	-	-	-	3	3
1	6	C	V	C	T	P	E	x	x	Elective-II	-	-	-	-	3	3
1	6	A	P	R	D	I	C	R	M	Research Methodology	2	-	-	-	2	2
													Total		25	26

L-Lecture Hours; **T**-Tutorial Hours; **P**-Practical Hours; **S**-Self study

Elective Courses – I & II									
	L	T	P	S		L	T	P	S
16CVCTPERC –Advanced Reinforced Concrete Design	3	-	-	-	16CVCTPE BS-Building Science	3	-	-	-
16CVCTPEQS- Construction Quality and Safety	3	-	-	-	16CVCTPE RE- Remedial Engineering	3	-	-	-
16CVCTPE DS- Advanced Design of Sub- Structures	3	-	-	-	16CVCTPE PD- Pavement Design and Construction	3	-	-	-



Note : Elective will be offered for a minimum strength of six candidates (out of 18) / eight candidates (out of 24)

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M.Tech.- Construction Technology- Scheme- 2016-17

II Semester

Course Code										Course Title	Credits					Contact Hrs/Wk
											L	T	P	S	Total	
1	6	C	V	C	T	P	C	E	F	Construction Economics and Finance	3	1	-	1	5	5
1	6	C	V	C	T	P	C	S	C	Sustainable Construction	3	-	1	-	4	5
1	6	C	V	C	T	P	C	C	C	Construction and Contract Management	4	-	-	-	4	4
1	6	C	V	C	T	P	E	x	x	Elective–III	-	-	-	-	4	4
1	6	C	V	C	T	P	E	x	x	Elective-IV	-	-	-	-	4	4
1	6	x	x	x	x	I	E	x	x	Elective-V (Institutional)	-	-	-	-	4	4
														Total	25	26

L-Lecture Hours; **T**-Tutorial Hours; **P**-Practical Hours; **S**-Self study

Elective Courses – III & IV									
	L	T	P	S		L	T	P	S
16CVCTPEPC –Prestressed concrete	4	-	-	-	16CVCTPEGT – Soil Exploration & ground Improvement Techniques	3	1	-	-
16CVCTPESM-Building Services and Maintenance	4	-	-		16CVCTPEPT- Pre-Engineered Construction Technology	3	-	-	1
16CVCTPE EB – Energy and Buildings	4	-	-	-	16CVCTPEER- Design of Earthquake Resistant Structures	3	1	-	-

Note : Elective will be offered for a minimum strength of six candidates (out of 18) / eight candidates (out of 24)

III Semester:

Course Code										Course Title	Credits				Contact Weeks
											L	T	P	Total	
1	6	C	V	C	T	P	C	I	T	Industrial Training	-	-	21	21	16 weeks
1	6	C	V	C	T	P	C	P	H	Major Project Phase-I	-	-	4	4	
													Total	**25**	

L-Lecture Hours; **T**-Tutorial Hours; **P**-Practical Hours; S-Self study

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IV Semester

Course Code										Course Title	Credits					Contact Weeks
											L	T	P	S	Total	
1	6	C	V	C	T	P	C	M	P	Major Project (Dissertation and Viva-Voce)	-	-	23	-	23	16
1	6	C	V	C	T	P	C	T	S	Technical Seminar	-	-	2	-	02	
Total															**25**	

L-Lecture Hours; **T**-Tutorial Hours; **P**-Practical Hours; **S**-Self study

I SEMESTER

MECHANIZATION IN CONSTRUCTION

Course Name	**MECHANIZATION IN CONSTRUCTION**	**Course Code**	**16CVCTPCMC**	**SEE Duration**	**03 Hrs**
Credits	**04**	**L-T-P-S**	**3-0-0-1**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Explain the advantages and limitations of mechanization through examples of landmark structures in India and abroad.

CO2: Identify the extent of mechanization in each and every construction activity**.**

CO3: Write, explain and compare conventional and modern construction technologies.

CO4: Outline the safety and environmental issues in mechanization**.**

Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario

Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers, scrapers, Excavators, Finishing equipment, Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells - Mechanization in aggregate manufacturing: Natural aggregates and recycled aggregates

Mechanization in rebar fabrication

Mechanization in concrete production and placement

Mechanization through construction: formwork and scaffolding-types, materials and design principles.

Mechanization through construction methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology.

Safety and Environmental issues in mechanization

REFERENCE BOOKS:

1. Peurifoy R L, "**Construction Planning, Equipment and Methods**", Mc Graw Hill
2. James F Russell, "**Construction Equipment**", Prentice Hall

CONSTRUCTION PROJECT MANAGEMENT

Course Name	CONSTRUCTION PROJECT MANAGEMENT	Course Code	16CVCTPCPM	SEE Duration	03 Hrs
Credits	**04**	**L-T-P-S**	**3-0-1-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify the organization structure of a project and provide an outline of project planning.

CO2: Draw a network diagram and carry out CPM and PERT analysis.

CO3: Develop resource plan, resource allocation and resource leveling for a construction project.

CO4: Estimate the time-cost trade–off in a construction project.

CO5: Work in a team to develop construction schedules for real time projects.

Project Organization, Bar Charts, Work Breakdown Structure, Time estimates, **Applications of CPM and PERT**- Scheduling, Monitoring and Updating. Line of Balance Scheduling.

Resource Planning-levelling and Allocation. Time-Cost Trade-off. Cost Control in Construction.

Introduction to Material Management- Purchase management and inventory control. Introduction to Building Information Model (BIM).

Laboratory Sessions:

Use of Construction management software packages

REFERENCE BOOKS:

1. Chitkara K K , "Construction Project Management, Planning, Scheduling and Controlling, Mc Graw Hill Education, 3rd Ed., 2014.
2. Peurifoy. R L, "**Construction Planning, Equipment and Methods**"- Mc Graw Hill.
3. Srinath L.S, "**PERT and CPM**", East West Press Pvt Ltd New Delhi.
4. Frank Harris and Roland McCaffer, "**Modern Construction Management**"- 4th Ed. Blackwell Science Ltd. 2009.

ADVANCES IN CONSTRUCTION MATERIALS

Course Name	ADVANCES IN CONSTRUCTION MATERIALS	Course Code	16CVCTPCCM	SEE Duration	03 Hrs
Credits	05	L-T-P-S	3-0-1-1	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify constituent of concrete material characteristics and different types of concrete for their appropriate use in construction.

CO2: Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

CO3: Distinguish concrete behavior based on its fresh and hardened properties.

CO4: Prepare a comprehensive report on new knowledge in any one of the topic related to concrete technology.

CO5: Evaluate a concrete mix designed for a specific construction project in terms of its relevance to ethical practices, social responsibility and reflective learning.

Concrete making materials- cement, aggregates, admixtures (both mineral and chemical). **Microstructure of concrete** - Fresh concrete and its rheology, Mechanical, deformational behaviour of hardened concrete. Creep and Shrinkage of Concrete. Durability of Plain and Reinforced Concrete.

Proportioning of Mixes- Normal Concrete, High Strength/Performance Concrete, Fibre Reinforced Concrete, Reactive Powder Concrete, Roller Compacted Concrete, Self-Compacting Concrete, Geo-polymer Concrete and Decorative Concrete,

Types of Reinforcements. Corrosion of Reinforcing Steel- Electro-chemical process, measures of protection. Polymers, fibres, adhesives and sealants- types and their uses. Structural glazing.

Laboratory session:

Open ended experiments to be carried out for a concrete mix designed for a real time project situation in groups to evaluate fresh, hardened and durable properties of concrete to supplement self- study component of learning.

REFERENCE BOOKS:

1. Neville A.M. “**Properties of Concrete**”- 5th Ed., Pearson Education Ltd., 2011.

2. Mehta .P.K., and Paulo J.M. Monteiro, "**Concrete- Microstructure, Properties and Materials**"-(Indian Ed., McGraw Hill Education, 2014.

E-Resources:

1. http://nptel.ac.in/courses/105102012/,
2. http://nptel.ac.in/courses/105106053/

STRUCTURAL MASONRY

Course Name	STRUCTURAL MASONRY	Course Code	16CVCTPCSM	SEE Duration	03 Hrs
Credits	04	L-T-P-S	3-0-1-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify various materials for masonry and understand its engineering properties.

CO2: Explain the parameters influencing masonry properties.

CO3: Develop an expression to understand the behavior of masonry under compression, shear and flexure.

CO4: Design masonry elements under different loads.

Introduction to Masonry structures, Materials for Masonry, Strength and elastic properties of masonry, Parameters influencing Masonry properties.

Behaviour of masonry under shear, flexure, and axial loads (static and dynamic).

Design of masonry structures, Masonry arches and Shells.

Introduction to Reinforced Masonry

Laboratory session:

Testing of masonry constituents: masonry units and mortar, Casting and testing of stack bonded masonry prisms and obtaining the stress-strain behavior under compression

REFERENCE BOOKS:

1. Hendry A W, "**Structural Masonry**"
2. Sven Sahlin, "**Structural Masonry**"
3. Curtin, "**Design of Reinforced and Pre-stressed Masonry**"
4. Dayaratnam P,"**Brick and Reinforced Brick Structures**"-Oxford and IBH pub.

ADVANCED REINFORCED CONCRETE DESIGN

Course Name	ADVANCED REINFORCED CONCRETE DESIGN	Course Code	16CVCTPERC	SEE Duration	03 Hrs
Credits	**03**	**L-T-P-S**	**3-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify the yield line patterns of slabs and apply the concepts to design the slabs.

CO2: Analyse and design components of complex RC structures as per BIS code.

CO3: Generate the reinforcement detailing of the designed RC structures.

Yield line method of design of slabs.

Design of grid floors.

Design of continuous beams.

Design of portal frames.

Design of silos and bunkers.

Design of flat slabs.

Art of detailing earthquake resistant construction – expansion and construction joints

REFERENCE BOOKS:

1. A Park and Paulay, "**Reinforced Reinforced and Prestressed Concrete**"-John Wiley & Sons
2. Lin TY and Burns N H, "**Reinforced Concrete Design**". John Wiley & Sons
3. Kong KF and Evans T H "**Design of Prestressed Concrete Structures**"
4. P.C.Varghese, "**Advanced Reinforced Concrete Design**"- Prentice-Hall of India, New Delhi, 2005.
5. Dr.B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, " **Comprehensive RCC Design**"

CONSTRUCTION QUALITY AND SAFETY

Course Name	CONSTRUCTION QUALITY AND SAFETY	Course Code	16CVCTPEQS	SEE Duration	03 Hrs
Credits	03	L-T-P-S	3-0-0-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Outline the importance of Quality and Safety in construction industry.

CO2: Explain the various Quality assessing tools as applied to construction sector.

CO3: Examine ACT 1996, BIS Safety standards and rules.

CO4: Understand the importance and need of a safety division and its role in construction projects.

Construction Quality, Inspection and Testing, Quality control, Quality Assurance, Quality **Certification for companies and laboratories** (ISO Certification, NABL certification), Total Quality Management, Critical factors of TQM, TQM in Projects, Benchmarking, concepts of quality policy, standards, manual, Third Party Certification

Construction Safety-meaning and scope, Safety in construction-Technological aspects, organizational aspects and behavioural aspects, Safety legislation and Standards, Contract conditions on safety in civil Engineering projects, Safety rules in construction, Safety in construction operations, Safety in the use of construction equipment, Ergonomics, Accident Prevention and safety, Construction Safety Management.

REFERENCE BOOKS:

1.N. Logothetis, "**Management for Total Quality**", Prentice Hall

2.David Gold Smith, "**Safety Management in construction and Industry**", Mc Graw Hill

3.K N Vaid, "**Construction Safety Management**", NICMAR, Bombay

4.D S Rajendra Prasad, "**Quality Management System in Civil Engineering**", Sapna Book House, Bangalore

5."**The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996"**, Universal Law Publishing Co. Pvt. Ltd.

ADVANCED DESIGN OF SUB STRUCTURES

Course Name	**ADVANCED DESIGN OF SUB STRUCTURES**	**Course Code**	**16CVCTPEDS**	**SEE Duration**	**03 Hrs**
Credits	**03**	**L-T-P-S**	**3-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Classify and suggest foundation type for various field and loading conditions, understand the basic requirements of a satisfactory foundation and the determinants of foundation location and depth, and proportion shallow foundations

CO2: Estimate individual vertical pile load capacity, pile group capacity, and pile group efficiency.

CO3: Comprehend the application and requirements of other types of deep foundations namely drilled piers, caissons and well foundations.

CO4: Develop an understanding of the various structural features required for a port structure and the various loading they will be subjected to.

CO5: Capable of assessing the forces, design criteria and choice of foundation for a transmission line tower.

Introduction: Introduction to sub structure, definition, purpose, requirements, types. **Foundation:** Types, selection criteria, requirements, load computation, design steps.

Shallow foundation: Types, depth of footings, loads, principles of design, proportioning of strip, spread, rectangular, trapezoidal, combined footings (no structural design), numerical problems on proportioning, raft foundation-design method, modulus of subgrade reaction.

Pile foundation: Introduction, necessity, various classifications, load carrying capacity, static method for driven piles in sand and clay, negative skin friction, dynamic formulae, pile group, group efficiency, numerical problems on above, under reamed piles, pile load test, concept of batter piles.

Drilled pier, Caissons, well foundation

Introduction, construction of drilled pier, merits & demerits of drilled piers, caissons-open type, pneumatic and floating caissons concept, advantages, disadvantages, stability of floating caissons. Well foundation types, shapes, forces acting, components, sinking of wells, tilts and shifts.

Marine substructures: Introduction, types, concepts of breakwater, wharves, pier, seawall, docks, quay walls, design loads, combined loads, and design method of break waters.

Foundation of transmission line towers: Introduction, necessary, forces, design criteria, choice of foundation, design procedure.

REFERENCE BOOKS:

1. Gopal Ranjan and ASR Rao, "**Basic and Applied Soil Mechanics**", New Age Int. (P) Ltd.
2. Swamisaran, "**Analysis and Design of Sub-Structures**", IBH & Oxford
3. B.M.Das, "**Principles of Foundation Engineering**", PWS Kent, Boston.
4. J.E. Bowles, "**Foundation Analysis and Design**", McGraw-Hills
5. Teng, "**Foundation Design**", Prentice Hall, Ind
6. K.R. Arora, "**Soil mechanics and foundation engineering**", Standard publishers distributors

BUILDING SCIENCE

Course Name	BUILDING SCIENCE	**Course Code**	16CVCTPEBS	**SEE Duration**	03 Hrs
Credits	03	L-T-P-S	3-0-0-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Interpret the physical phenomenon of weather on buildings

CO2: Identify and analyse materials suitable for optimal environmental performance on buildings

CO3: Design integrated systems to optimize building performance

Climatic factors, Classification of tropical climates, site climate, micro climate of human settlements, ventilation requirements for health, mechanisms and estimation of natural ventilation, airflow patterns in building

Thermal comfort factors, thermal indices, thermal quantities, heat exchange in buildings, periodic heat flow, mechanical and structural means of thermal control.

Propagation of sound, sound insulation, absorption, transmission reverberation roofing and walling system for sound absorption and insulation, noise and noise control in buildings.

Principles of day lighting in buildings

REFERENCE BOOKS:

1. Koenigsberger, "**Manual of Tropical Housing and Building- Climatic Design**", Orient Longman
2. Deodhat, S V , "**Building Science and Planning**", Khanna Pub.
3. B C Punmia, "**Building Construction**", Laxmi Pub
4. **SP:41- Functional Requirements for Buildings**, BIS, New Delhi

REMEDIAL ENGINEERING

Course Name	REMEDIAL ENGINEERING	Course Code	16CVCTPERE	SEE Duration	03 Hrs
Credits	**03**	**L-T-P-S**	**3-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify the various causes of deterioration of structures and relate it to the effects.

CO2: Choose the diagnostic methods and tools after identifying the levels of distress in structures.

CO3: Formulate a strategy for repair and rehabilitation by selecting appropriate repair materials and techniques.

CO4: Infer the results of a case study and provide techniques for repair.

General : Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT

Influence on Serviceability And Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

Materials for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete.

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete, Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Examples of Repair: To Structures Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies

REFERENCE BOOKS

1. Sidney., M. Johnson "**Deterioration Maintenance and Repair of Structures**"

2. R.N. Raikar "**Rehabilitation of Structures**"- Edited by, Vol. 1, 2 and 3, Proc., Int. Symposium, Maharashtra Indian Chapter of ACI, Bombay

3. Denison Campbell, Allen & Harold Roper," **Concrete Structures– Materials, Maintenance and Repair**"- Longman Scientific and Technical

4. **CPWD Hand book on Repair and Rehabilitation of RCC Buildings**, DG(W), Central Public Works Department, New Delhi, 2002.

PAVEMENT DESIGN AND CONSTRUCTION

Course Name	PAVEMENT DESIGN AND CONSTRUCTION	Course Code	16CVCTPEPD	SEE Duration	03 Hrs
Credits	**03**	**L-T-P-S**	**3-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Analyse the difference between the design principles of flexible and rigid pavements including evaluation of stresses from loads from vehicles, EWL concepts and layered system concepts.

CO2: Prepare flexible pavement design based on laboratory and theoretical methods as per IRC guidelines.

CO3: Prepare rigid pavement design based on laboratory and theoretical methods as per IRC guidelines.

CO4: Learn the various equipments to be used for road construction including some special equipments.

CO5: Understand the construction procedure principles for various layers of flexible pavement like earthwork, GSB, Base course and surface course including specification and quality control tests.

CO6: Understand the construction procedure principles for various layers of rigid pavement like laying of pavement quality concrete including specification and quality control tests.

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

Stresses and Deflections In Flexible Pavements: Stresses and deflections in homogeneous masses. wheel load stresses, various factors in traffic wheel loads;
ESWL and EWL factors.

Flexible Pavement Design Methods For Highways : CBR method-Principle – Testing as per IRC, AASHTO and Asphalt Institute and Shell Method. Problems on above

Stresses in Rigid Pavements: Factors affecting design and performance of pavements. Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL, wheel load stresses, warping stresses, frictional stresses, combined stresses. Problems on above Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacing; design of CC pavement for roads and runways, design of joint details for longitudinal joints, contraction joints and expansion joints. IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements, Problems on above

Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction

Subgrade: Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests

Flexible Pavements: Specifications of materials, construction method and field control checks for various types of flexible pavement layers – WBM-BM- SDBCBC

Cement Concrete Pavements: Specifications and method of cement concrete pavement construction; Quality control tests; Construction of various types of joints.

REFERENCE BOOKS:

1. Yoder, E.J., and Witczak, "**Principles of Pavement Design**"- 2nd ed. John Wiley and Sons, 1975.

2. Yang, "**Design of Functional Pavements**"- McGraw Hill Book Co.

3. Khanna and Justo, "**Test Book of Highway Engineering**"- Nemchand brothers, Roorke- 2004.

4. Huang, "**Pavement Analysis**"- Elsevier Publications

5. HRB/TRB/IRC/International Conference on "**Structural Design of Asphalt Pavements**".

6. "**Relevant IRC Publications**"

7. "**CMA Hand Book**"

8. Sharma, S.C."**Construction Equipment and its Management**"- Khanna Publishers

RESEARCH METHODOLOGY

Course Name	**RESEARCH METHODOLOGY**	**Course Code**	**16APRDICRM**	**SEE Duration**	**03 Hrs**
Credits	**02**	**L-T-P-S**	**2-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Define the research problem, identify objectives and develop a methodology for the research problem

CO2: Intrepret the literature, analyse the findings of research and technical reports and thesis

Module 1:

Meaning, Objectives and Characteristics of research - Research methods Vs Methodology - Types of research - Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs.Qualitative, Conceptual Vs. Empirical - Research process - Criteria of good research - Developing a research plan.

Module 2:

Defining the research problem - Selecting the problem - Necessity of defining the problem -Techniques involved in defining the problem-Importance of literature review in defining a problem- Survey of literature - Primary and secondary sources - Reviews, treatise, monographs-patents - web as a source - searching the web - Identifying gap areas from literature review -Development of working hypothesis.

Module 3:

Research design and methods – Research design – Basic Principles- Need of research design –Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models - Developing a research plan - Exploration, Description, Diagnosis, and Experimentation- Determining experimental and sample designs.

Module 4:

Sampling design - Steps in sampling design - Characteristics of a good sample design - Types of sample designs - Measurement and scaling techniques- Methods of data collection – Collection of primary data - Data collection instruments

Module 5:

Testing of hypotheses - Basic concepts – Procedure for hypotheses testing flow diagram for hypotheses testing - Data analysis with Statistical Packages – Correlation and Regression - Important parametric test - Chi-square test – Analysis of variance and Covariance

Module 6:

IPRs- Invention and Creativity- Intellectual Property-Importance and Protection of Intellectual Property Rights (IPRs)- A brief summary of: Patents, Copyrights, Trademarks, Industrial Designs- Integrated Circuits-Geographical Indications-Establishment of WIPO-Application and Procedures**.**

Module 7:

Interpretation and report writing - Techniques of interpretation - Structure and components of scientific reports - Different steps in the preparation - Layout, structure and language of the report - Illustrations and tables - Types of report - Technical reports and thesis

REFERENCE BOOKS:

1.Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. “**An introduction to Research Methodology”**, RBSA Publishers.

2.Kothari, C.R., 1990. “**Research Methodology: Methods and Techniques**”. New Age International. 418p.

3.Anderson, T. W., “**An Introduction to Multivariate Statistical Analysis**”, Wiley Eastern Pvt., Ltd., New Delhi

4.Sinha, S.C. and Dhiman, A.K., 2002. “**Research Methodology**”, Ess Ess Publications. 2 volumes.

5.Trochim, W.M.K., 2005. “**Research Methods: the concise knowledge base**”, Atomic Dog Publishing. 270p.

6.Day, R.A., 1992.”**How to Write and Publish a Scientific Paper**”, Cambridge University Press.

7.Fink, A., 2009. “**Conducting Research Literature Reviews: From the Internet to Paper**”.Sage Publications

8.Coley, S.M. and Scheinberg, C. A., 1990, "**Proposal Writing**", Sage Publications.

9. Keith Eugene Maskus , “**Intellectual Property Rights in the Global Economy**”:, Institute for International Economics, Washington, DC, 2000

10.Subbarau NR-“**Handbook on Intellectual Property Law and Practice**”-S Viswanathan Printers and Publishing Private Limited.1998

II SEMESTER

CONSTRUCTION ECONOMICS AND FINANCE

Course Name	CONSTRUCTION ECONOMICS AND FINANCE	Course Code	16CVCTPCEF	SEE Duration	03 Hrs
Credits	**05**	**L-T-P-S**	**3-1-0-1**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Apply the concept of time value of money to different real time situations

CO2: Analyse different economic feasible alternatives using present worth/rate of return methods of investment.

CO3: Demonstrate construction accounting principles to prepare financial statements.

CO4: Appraise financial health of construction organizations using financial evaluation tools

CO5: Develop a comprehensive investment proposal on any construction enterprise

Engineering economics -Time value of money, discounted cash flow, NPV, ROR, Bases of comparison of alternatives, Incremental analysis, Benefit-Cost analysis, Breakeven analysis.

Equipment economics - Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

Financial management - Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

REFERENCE BOOKS:

1. Blank L and Anthony T, " **Basics of Engineering Economy**", Mc Graw Hill Education, Indian Edition, 2013.
2. Peurifoy, R. L., Schexnayder, C. J. and Shapira, A., "**Construction Planning, Equipment, and Methods**", 7th ed., Tata McGraw-Hill, New Delhi, 2010.
3. Van Horne J.C, "**Fundamentals of Financial Management**" Prentice Hall.
4. Bose, D. C., "**Fundamentals of Financial management**", 2nd ed., PHI, New Delhi, 2010.

E-Resources:

1. http://nptel.ac.in/courses/105103023/

SUSTAINABLE CONSTRUCTION

Course Name	SUSTAINABLE CONSTRUCTION	Course Code	16CVCTPCSC	SEE Duration	03 Hrs
Credits	04	L-T-P-S	3-0-1-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify principles of sustainability and its role in construction sector

CO2: Compute the life cycle energy of a typical building

CO3: Develop recycling process for various types of marginal materials

CO4: Characterize marginal materials

CO5: Evaluate recycled products made from marginal materials

CO6: Assess sustainability through rating systems

Introduction to sustainability: Sustainability principles, concept of zero waste, 3 R's principles, sustainability concept in construction industry, need, objectives, achieving sustainability at various stages of construction, resource economics, waste minimization techniques, Governmental and citizen's role, demolition and De-construction techniques.

Energy concepts for sustainability: Concept of Embodied energy, importance of embodied energy, constituents of embodied energy, Operational energy, Life cycle energy, case study of a typical building, typical embodied energy values of few materials of construction, concept of net zero energy building

Sustainable materials and resources: Concept of recyclability, use of marginal materials in construction of civil engineering structures, use of processed demolished materials and construction waste, use of recycled materials: aluminum, steel, wood, flyash, GGBS, gypsum, manufactured sand

Assessment of Sustainability: Introduction and brief description of existing rating systems for sustainable building design and construction (both new and for renovations), LEED rating system, GRIHA rating system for green buildings.

Laboratory session:

Testing of marginal materials, material characterization, evaluation of mortar/concrete/masonry units made with marginal materials.

REFERENCE BOOKS:

1. Richard Ian Stessel.,"**Recycling and Resource Recovery Engineering**", Springer-Verlag Berlin Heidelberg (1996)

2. Greg Winkler, "**Recycling Construction and Demolition waste: A LEED-Based Toolkit**" (Green Source) (Google ebook), McGraw Hill Professional

3. V M Tam, Chi Ming Tam, "**Reuse of Construction and Demolition Waste in Housing Development**", Nova Science Publishers, 2008

4. Meg Calkins , " **Materials for sustainable sites**", John Wiley and Sons Inc.

5. Charles Kibert, "**Sustainable construction- Green Building Design and Delivery**", John Wiley and sons

6. Michael Ashby, "**Material and Environment**", Elsevier Inc

7. "**Recycling, Use and Management of C & D wastes**", ICI Bulletin 01, Indian Concrete Institute, 2015

CONSTRUCTION AND CONTRACT MANAGEMENT

Course Name	**CONSTRUCTION AND CONTRACT MANAGEMENT**	**Course Code**	**16CVCTPCCC**	**SEE Duration**	**03 Hrs**
Credits	**04**	**L-T-P-S**	**4-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Prepare the project cost estimate

CO2: Compose the tender and contract documents

CO3: Identify the appropriate types of contract for a given construction project

CO4: Interpret claim records to solve arbitration cases.

Project cost estimation, rate analysis-labour, materials and equipment production, Overhead charges, Bidding models and strategies, Qualification of bidders.

Tendering and contractual procedures, Indian Contract Act 1872 as applied to construction,

Types of contracts, International contracts, Conditions and specifications of contract, Contract administration,

Claims, compensation and disputes, Dispute resolution techniques, Arbitration and Conciliation Act 1996 – case studies,

Professional ethics, Duties and responsibilities of parties.

REFERENCE BOOKS:

1. Roshan Namavathi, "**Professional Practice**"
2. Gajaria GT, "**Law Relating to Building & Civil Engg. Contracts in India**"
3. Collier, Kieth, "**Managing Construction Contracts**"

PRE-STRESSED CONCRETE

Course Name	PRE-STRESSED CONCRETE	Course Code	16CVCTPEPC	SEE Duration	03 Hrs
Credits	**04**	**L-T-P-S**	**4-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Evaluate the internal stresses of a PSC element and estimate the resultant stress at any section and to generate the pressure line.

CO2: Evaluate the losses in PSC members to determine the effective prestressing force.

CO3: Analysis and design PSC members for flexure shear and torsion.

CO4: Evaluate an change zone stresses and design the anchorage zones

High strength materials, Pre-stressing systems, losses in pre-stress.

Analysis of P.C. Members for flexure, shear, torsion.

Design of reinforcement for shear, flexure and torsion.

Anchorage zone stresses in Pre-tensioned and Post – tensioned members.

Concept of transmission, length, bond stresses.

Design of anchorage zone reinforcement.

Introduction to Post-tensioning of flat slabs.

REFERENCE BOOKS:

1. A Park and Paulay, "**Reinforced Reinforced and Pre-stressed Concrete**", John Wiley & Sons.

2. Lin TY and Burns N H, "**Reinforced Concrete Design**".

3. Kong KF and Evans T H "**Design of Pre-stressed Concrete Structures**"

BUILDING SERVICES AND MAINTENANCE

Course Name	BUILDING SERVICES AND MAINTENANCE	Course Code	16CVCTPESM	SEE Duration	03 Hrs
Credits	**04**	**L-T-P-S**	**4-0-0-0**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Describe the basics of house plumbing and waste water collection and disposal.

CO2: Discuss the safety and guidelines with respect to fire safety.

CO3: Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.

Standard fire, fire resistance, classification of buildings, means of escape, alarms, etc., provisions of NBC.

Engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.

Building Maintenance: Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

REFERENCE BOOKS:

1. **NBC," Relevant Parts**: BIS New Delhi
2. Jain V K," **Services in Building Complex and High Rise Buildings**",Khanna Pub.
3. Pchelinstev V. A., **Fire Resistance of Buildings**.

ENERGY AND BUILDINGS

Course Name	ENERGY AND BUILDINGS	Course Code	16CVCTPEEB	SEE Duration	03 Hrs
Credits	04	L-T-P-S	4-0-0-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Relate the issues concerning energy and buildings.

CO2: Explain the key concepts in green building rating systems

CO3: Explain life cycle analysis with help of examples.

CO4: Write, explain and compare energy efficient materials and technologies.

Introduction, Energy and Buildings – Zero carbon buildings, energy efficiency, energy monitoring, energy modeling, carbon reduction in buildings, renewable energy sources,.

Computation of embodied energy, life cycle energy assessment - case studies.

Green building concepts, rating standards – case studies.

Energy efficient materials and Technologies.

REFERENCE BOOKS:

1. Dejan Mumovic and Mat Santamouris " **A hand book of Sustainable Building Design & Engineering – An Integrated approach to energy, health and operational performance"**, Earthscan publishing house, 2009.

SOIL EXPLORATION AND GROUND IMPROVEMENT TECHNIQUES

Course Name	SOIL EXPLORATION AND GROUND IMPROVEMENT TECHNIQUES	Course Code	16CVCTPEGT	SEE Duration	03 Hrs
Credits	04	L-T-P-S	3-1-0-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify and prioritize different methods of boring and sampling techniques for soil exploration.

CO2: Laboratory and field testing of soil exploration samples.

CO3: Preparation of test reports to evaluate the economics of soil exploration.

CO4: Implement different methods of soil improvement techniques.

CO5: Analyse different case histories of soil exploration methods and ground improvement techniques.

Principles of exploration: Geophysical and sounding methods, Modern methods of boring and sampling ; Preservation and transportation of samples; Sampling records, Soil profiles, **Various types of field tests**; Instrumentation; Investigation below sea/river bed; offshore investigation; investigation; interpretation of exploration data and report preparation; economics of field testing & lab testing.

Engineering properties of soft & weak and compressible deposits; principles of treatment; **Methods of soil improvement**-lime stabilization and injection; thermal, electrical and chemical methods; Dynamic consolidation; vibroflotation; compaction by blasting; pre-consolidation with vertical drains; Granular piles; soil nailing; Anchors; Grouting; Electro-osmosis; Soil freezing; Vacuum consolidation; Case histories Soil confinement

REFERENCE BOOKS:

1. Hvorslev MJ, "**Subsurface Exploration and Sampling of Soils for Civil Engg. Purposes**" Elsevier Pub. Co

2. Manfredd RH, "**Engineering Principles of Ground Modification**", Mc Graw Hill

3. Head KH, "**Manual of Soil Laboratory Testing**".

4. Purushotham Raj, "**Ground Improvement Techniques**".

PRE ENGINEERED CONSTRUCTION TECHNOLOGY

Course Name	**PRE ENGINEERED CONSTRUCTION TECHNOLOGY**	**Course Code**	**16CVCTPEPT**	**SEE Duration**	**03 Hrs**
Credits	**04**	**L-T-P-S**	**3-0-0-1**	**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Understand general principles of pre-fabrication.

CO2: Plan simple buildings using various types of prefabricated elements.

CO3: Design simple prefabricated elements

CO4: Outline the various phases involved in precast/pre-fabricated technology

CO5: Distinguish pre-engineered buildings from conventional units

General Principles of Fabrication

Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication - Economy of prefabrication – Modular coordination – Standardization – Planning for Components of prefabricated structures – Disuniting of structures – Design of simple rectangular beams and I beams – Handling and erection stresses – Elimination of erection stresses – Beams, columns – Symmetrical frames.

Prefabricated Elements

Roof and floor panels, ribbed floor panels – wall panels – footings – Joints for different structural Connections – Effective sealing of joints for water proofing – Provisions for non-structural fastenings –Expansion joints in pre-cast construction. Designing and detailing of precast unit for factory structures –Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Single span single storeyed frames –Single storeyed buildings – slabs, beams and columns.

Production and Hoisting Technology

Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening. Equipments for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads.

Pre-Engineered Buildings

Introduction – Advantages - Pre Engineered Buildings Vs Conventional Steel Buildings - Design of Pre Engineered Buildings (PEB) – Applications

REFERENCE BOOKS:

1. L. Mokk, "**Prefabricated Concrete for Industrial and Public Structures"**, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. T. Koncz, "**Manual of Precast Concrete Construction, Vol. I, II, III & IV**", Berlin, 1971.
3. B. Lewicki, "**Building with Large Prefabricates**", Elsevier Publishing Company, Amsterdam, London, New York, 1998.
4. "**Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete**", Netherland Betor Verlag, 2009.
5. Hass, A.M. "**Precast concrete design and Applications**", Applied Science Publishers, 1983.
6. "**Handbook on Precast concrete for buildings**", ICI Bulletin 02, Indian Concrete Institute, 2016
7. "**National Building Code of India**", BIS, New Delhi, 2005

DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Course Name	DESIGN OF EARTHQUAKE RESISTANT STRUCTURES	Course Code	16CVCTPEER	SEE Duration	03 Hrs
Credits	04	L-T-P-S	3-1-0-0	CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Describe the fundamentals of engineering seismology.

CO2: Characterise the earthquake ground motions and prepare the basis for estimations of seismic forces.

CO3: Analysis, design and detailing the building components for seismic resistance as per BIS codal provisions.

CO4: Identify and discuss the failure patterns of building during earthquake.

Introduction to engineering seismology, characteristics of earthquake and its quantification, seismological instrumentation in buildings, introduction to structural dynamics of buildings, Seismic response of buildings and sites –

Dynamic properties of buildings and sites, building code requirements for earthquake effects, forms of seismic response, structural response, structural failures, non-structural damage, behaviour of ordinary construction, site failures, building foundation failures. **Desirable features of earthquake resistant buildings**, damping, ductility and energy absorption in buildings, details of providing ductility in structures, lessons from structural damage during past earthquakes.

Earthquake analysis of linear systems- Response history analysis and response spectrum analysis. Earthquake analysis of multistoried RC structure, discussion of IS code provisions of Earthquake resistant design of buildings. Design of basic structural elements (Reinforced concrete) such as beams, columns and slabs subjected to dynamic loads by limit state method. Concepts for Earthquake resistant masonry – IS codal provisions

REFERENCE BOOKS:

1. Minoru Wakabayashi, "**Design of Earthquake Resistant Buildings**"- McGraw Hill Pub.

2. Anil K Chopra, "**Dynamics of Structures – Theory and Application to Earthquake Engineering**"- 2nd ed., Pearson Education pub.

3. Anderson,R.A., "**Fundamentals of Vibrations**"- Mc Millan

4. **IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993**

5. Timoshenkeo, S., “**Vibration and Stuctural Dynamics**”-VanNostrand Co.,

6. Clough and Penzien, “**Dynamics of Structures**”.

7. Mukyopadhyaya, “**Vibration and Structural Dynamics**”- Oxford &IBH

8. James Ambrose and Dimitry Vergun, “**Design for Earthquakes**”.

9. David Key, “**Earthquake Design Practice for Buildings**”,Thomas Telford.

III SEMESTER

INDUSTRIAL TRAINING

Course Name	INDUSTRIAL TRAINING	Course Code	16CVCTPCIT	SEE Duration	03 Hrs
Credits	21			CIE+SEE	50+50

Course Outcomes: At the end of the course, students will be able to:

CO1: Comprehend construction company organizational/financial structure.

CO2: Demonstrate professional skills relevant to construction technology.

CO3: Apply and correlate theory and practice and to communicate effectively regarding complex Engineering activities.

CO4: Engage in life-long learning by observing and examining critically and make corrections cautiously.

MAJOR PROJECT PHASE - I

Course Name	**MAJOR PROJECT PHASE - I**	**Course Code**	**16CVCTPCPH**		
Credits	**4**			**CIE**	**100**

Course Outcomes: At the end of the course, students will be able to:

CO1: Exhibit application of knowledge, critical thinking and formulate problem in the field of construction materials/ technology.

CO2: Demonstrate skills on research literature.

IV SEMESTER

MAJOR PROJECT (DISSERTATION AND VIVA-VOCE)

Course Name	**MAJOR PROJECT (DISSERTATION AND VIVA-VOCE)**	**Course Code**	**16CVCTPCMP**	**SEE Duration**	**03 Hrs**
Credits	**23**			**CIE+SEE**	**50+50**

Course Outcomes: At the end of the course, students will be able to:

CO1: Demonstrate skills in developing research methodologies and designing of experiments

CO2: Analyse and interpret the analytical and experimental data effectively.

CO3: Communicate confidently and comprehend and write reports effectively.

TECHNICAL SEMINAR

Course Name	TECHNICAL SEMINAR	Course Code	16CVCTPCTS	SEE Duration	03 Hrs
Credits	2			CIE	100

Course Outcomes: At the end of the course, students will be able to:

CO1: Identify social relevant state of the art technology for the benefit of society and research literature.

CO2: Exhibit Independent and Reflective Learning through scholarly presentation and reporting.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. (Environmental Engineering)

I Semester **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14CEE11	APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY	4	2	3	50	100	150	4
14CEE12	WATER TREATMENT TECHNOLOGY	4	2	3	50	100	150	4
14CEE13	WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS	4	2	3	50	100	150	4
14CEE14	SOLID WASTE MANAGEMENT	4	2	3	50	100	150	4
14CEE15X	Elective - 1	4	2	3	50	100	150	4
14CEE16	Computer applications Laboratory -I	--	3	3	25	50	75	2
14CEE17	Seminar	--	3	--	25	--	25	1
	Total	**20**	**16**	**18**	**300**	**550**	**850**	**23**

Elective – 1

1. ADVANCED COMPUTATIONAL METHODS AND OPTIMIZATION
2. OCCUPATIONAL SAFETY AND HEALTH
3. REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING

VTU ORIGINAL PG SCHEME

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR

M.Tech. (Environmental Engineering)

II Semester **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14CEE21	ATMOSPHERIC ENVIRONMENTAL POLLUTION AND CONTROL	4	2	3	50	100	150	4
14CEE22	ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT	4	2	3	50	100	150	4
14CEE23	WASTEWATER TREATMENT ENGINEERING	4	2	3	50	100	150	4
14CEE24	TRANSPORT PROCESSES AND MODELLING OF AQUATIC SYSTEMS	4	2	3	50	100	150	4
14CEE25X	Elective-2	4	2	3	50	100	150	4
14CEE26	Computer applications Laboratory -II		3	3	25	50	75	2
14CEE27	Seminar	--	3	--	25	--	25	1
	**Project Phase-I(6 week Duration)	--	--	--	--	--	--	--
	Total	**20**	**16**	**18**	**300**	**550**	**850**	**23**

Elective – 2

1. ENVIRONMENTAL PLANNING AND MANAGEMENT
2. .HAZARDOUS WASTE MANAGEMENT

3.GLOBAL WARMING AND CLIMATE CHANGE

**** Between the II Semester and III Semester, after availing a vocation of 2 weeks.**

VTU ORIGINAL PG SCHEME

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR

M.Tech. (Environmental Engineering)

III Semester: INTERNSHIP **CREDIT BASED**

Course Code	Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14CEE31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	1
14CEE 32	Report on Internship	-	-	-		75	75	15
14CEE 33	Evaluation and Viva-voce	-	-	-	–	50	50	4
	Total	**-**	**-**	**-**	**25**	**125**	**150**	**20**

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising **Internship** Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VTU ORIGINAL PG SCHEME

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR

M.Tech. (Environmental Engineering)

IV Semester **CREDIT BASED**

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Field Work / Assignment / Tutorials		I.A.	Exam		
14CEE41	INDUSTRIAL WASTEWATER TREATMENT	4	2	3	50	100	150	4
14CEE42 X	Elective-3	4	2	3	50	100	150	4
14CEE43	Evaluation of Project Phase-I	-	-	-	25	-	25	1
14CEE44	Evaluation of Project Phase-II	-	-	-	25	-	25	1
14CEE45	Evaluation of Project Work and Viva-voce	–	-	3	-	100+100	200	18
	Total	**8**	**04**	**09**	**150**	**400**	**550**	**28**
Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits								

Elective – 3

1. NON – POINT SOURCES OF POLLUTION AND MANAGEMENT
2. ADVANCED ATMOSPHERIC ENVIRONMENTAL ENGINEERING
3. TOXICOLOGY & ENVIRONMENTAL RISK ASSESSMENT

VTU ORIGINAL PG SCHEME

Note:

1) Project Phase – I**:** 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation.
2) Project Phase – II**:** 16 weeks duration during III Semester. Evaluation shall be taken during the Second week of the IV Semester. Total Marks shall be 25.
3) Project Evaluation: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 250 (Phase I Evaluation: 25 Marks, Phase –II Evaluation: 25 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, marks for external and 100 for viva-voce).

   Marks of Evaluation of Project:

   - The I.A. Marks of Project Phase – I & II shall be sent to the University along with Project Work report at the end of the Semester.
4) During the final viva, students have to submit all the reports.
5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:

   a) Head of the Department (Chairman)
   b) Guide
   c) Two Examiners appointed by the university. (Out of two external examiners at least one should be present).

VTU ORIGINAL PG SCHEME

VTU ORIGINAL PG SCHEME

I SEMESTER

APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

Subject Code**: 14 CEE-11**	IA Marks: 50
No. of Lecture Hrs/ Week - 04	Exam Hrs: 03
Total no. of Lecture Hrs. - 50	Exam Marks: 100

Objectives: To train the engineers and researchers to know the basic composition of materials, technology for measurement of its concentration and and technology for environmental conservation, and aspire to improve welfare and sustainability of our society by applying their chemical knowledge. Microbiology provides a general introduction to the diverse roles of microorganisms in natural and artificial environments.

Course Outcomes: On completion of this course, students are able to

- Master a broad set of chemical knowledge concerning the fundamentals in the basic areas of the discipline (organic, inorganic, analytical, physical and biological chemistry).
- Demonstrate that microorganisms have an indispensable role in the environment, including elemental cycles, biodegradation, etc.

Introduction: Importance of Environmental Chemistry, types of reactions, redox reactions, reaction kinetics. Electrochemistry and its applications. Physical and equilibrium chemistry–fundamentals and applications. Trace Contaminants and their analyses. pH – Principle, Measurement, Numerical Examples, Buffers and Buffer index. (10hr)

Colloidal Chemistry: Properties of colloids, colloidal dispersions, stability of colloids and applications.
Applications of Organic Chemistry in Environmental Engineering. (10hr)

Colourimetry: Principles and applications. Applications of Analytical Chemistry – emission and absorption techniques. (10hr)

Water & wastewater analysis: Fluoridation, deflouridation**, chlorination,** BOD, DO, types and measurement of BOD, rate of BOD & theoretical oxygen removal, COD- determination & its application in wastewater treatment. (10hr)

Microbiology - Microorganisms of importance in air, water and soil environment Principles and applications of microscopy, microscopic flora and fauna of importance.
Metabolism and metabolic pathways, Bioconcentration, Biomagnification and Bioaccumulation.
Bacteria **–** Morphology, typical growth curve and generation time, Measurement Techniques – APC, MPN (Probability and Thomas methods), MFT. Monod's equation and its applications. Algae - orphology, classification and their importance. Fungi - Protozoa - morphology, classification and their importance. Enzymes - classification, kinetics - Michaelis-Menten equation, factors influencing enzyme reaction.
Virology - Types, characteristics and enumeration methodology. (10hr)

VTU ORIGINAL PG SCHEME

REFERENCES

1. McKinney R.E."**Microbiology for Sanitary Engineers**", Newyork McGraw Hill.
2. Sawyer C.N. and McCarty, P.L ., , **"Chemistry for Environmental Engineering and Science**", 5th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Pelczar M.J ,Chan ECS, Krieg, NR **"Textbook of Microbiology"** 5th edition Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Gaudy and Gaudy, "**Microbiology for Environmental Scientists and Engineers**", McGraw Hill.
5. APHA, "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.
6. Stumn and Morgan, "**Aquatic Chemistry",** John Willey & Sons Newyork
7. **Relevant Journals**

I SEMESTER

WATER TREATMENT TECHNOLOGY

Subject Code**: 14 CEE-12**	IA Marks: 50
No. of Lecture Hrs/ Week:04	Exam Hrs: 03
Total no. of Lecture Hr: 50	Exam Marks: 100

Objectives: The course is designed to train students in the practical aspects of operating and maintaining water treatment plants, emphasizing safe practices and procedures.

Course Outcomes: On completion of this course, students are able to

- Understand the principles and operation of water treatment systems
- Appraise the suitability of the design of treatment plants and unit processes
- Evaluate process operations and performance
- Understand coagulation, flocculation, and sedimentation, filtration, and disinfection processes.

Introduction: Sources of water, necessity of treatment, Critical Water quality parameters, water quality guidelines and standards for various water uses.
Unit operations: Principles and design of aeration systems – two film theory, water in air system, air in water system.
Intake structures: Different types, design criteria.(10hr)

Principles of sedimentation: Types of settling and settling equations, design criteria and design of settling tanks. **Principle of Coagulation and Flocculation:** types of coagulants, coagulant aids, coagulation theory, optimum dose of coagulant, design criteria and numerical examples.(10 hr)

Filtration: Theory, types, hydraulics of filter bed, design criteria and design of filters, filter backwash, operational problems and trouble shooting. (10 hr)

Adsorption Process: Types, factors affecting adsorption, kinetics and equilibrium – different isotherm equations and their applications.(10 hr)

Unit processes: disinfection – different types, disinfectants, factors affecting disinfection, methods of disinfection, chemistry of chlorination. Water Softening – Ions causing hardness, Langelier index, various methods. Fluoridation and defluoridation – Principles and design.
Trace organic contaminants in water supplies and their removal.
Bench Scale and Pilot Plant studies in water treatment. Rural Water Supply Systems.(10 hr)

REFERENCES

1. Fair, G.M., Geyer J.C and Okun, **Water and Waste water Engineering**" Vol II, John Wiley Publications.
2. Weber W.J., "**Physico - Chemical Processes for Water Quality Control**".
3. APHA, AWWA, AAWF, "**Water Quality and Treatment** "McGraw Hill.
4. CPHEEO Manual on "**Water Supply and Treatment",** .available at Jain Book agency, C-9, Connaught place, New Delhi
5. Peavy, H.S., Rowe and Tchobonoglous,G., **"Environmental Engineering**", McGraw Hill
6. Raju, B.S.N., "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt Ltd., New Delhi.
7. World Health Organization, Geneva, Guidelines for Drinking Water Quality, Third Edition, Volumes 1-3.

VTU ORIGINAL PG SCHEME

WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS

Subject Code: **14 CEE-13**	IA Marks : 50
No. of Lecture Hrs/ Week: 04	Exam Hrs : 03
Total no. of Lecture Hrs: 50	Exam Marks : 100

Objectives: The course is designed to deal with surface and groundwater, addressing both water quantity and quality, learning to understand human influences on the hydrological system, and apply tools, for the proper integration of hydrological knowledge and analysis in water resources planning and management.

Course Outcomes: On completion of this course, students are able to

- Understand theories and concepts in surface and subsurface hydrology, the physical, chemical and biological interactions between the hydrosphere, the lithosphere, the biosphere and the atmosphere
- A thorough awareness of natural and human-induced variations of hydrological systems
- Evaluate and analyze hydrological systems and processes at a wide range of scales in both space and time for the purpose of water resources assessment, natural hazard assessment and mitigation, and environmental planning and management.

Hydrology: Water resources of the world, India and Karnataka, National Water Policy, Hydrologic cycle, estimation of missing precipitation and rain gauge density.(10 hr)

Hydrograph theory: Unit hydrograph-derivation, flow routing, low flow analysis.
Urban Hydrology - Run-off estimation – Design of Storm water Drains. (10 hr)

Unsteady Flow through Conduits: Water hammer analysis, Water hammer protection methods - surge tanks, Flow Measurements – Area –Velocity method, Weir method, flumes, end-depth method & chemical and radioactive tracers method (10 hr)

Groundwater: Basic equations of flow, confined and unconfined aquifers, sea water intrusion, artificial recharge, groundwater pollution, borewells - types & design principles, open wells – types, yield tests.(10 hr)

Basics and applications of Remote Sensing: in water resources management, Hydraulic transients- flow through bends & constriction (10 hr)

REFERENCES

1. Raghunath H.M. "**Advanced Hydrology**", Wiley Eastern Ltd New Delhi
2. Subramanya K.S, "**Advanced Hydrology".Tata Mc Graw Hill, New Delhi**
3. David Keith Todd, "**Ground Water Hydrology**".2nd Edition John Wiley & Sons New Delhi
4. Sabins F.F., "**Remote Sensing – Principles and Interpretations**", W.H. Freeman & Co.
5. Anji Reddy, "**Remote Sensing and GIS**", B.S. Publications, Hyderabad.
6. Ven T. Chow, "**Hand Book of Applied Hydrology",** 1st Edition Mc Graw Hill Publications
7. Hammer M.J, and Mackichan K.A. "**Hydrology and Quality of Water Resources**", Newyork:Wiley.
8. John Permankian, **"Water Hammer Analysis**".
9. Linsley, Franzini, Freyberg, Tchobanoglous G. "**Water Resources Engineering**", TATA McGraw Hill Series.
10. Linsley, Kohler and Paulhes, "**Hydrology for Engineers**", McGraw Hill.
11. Mays L.W. , **"Water Resources Engineering**", John Wiley and Sons Publications.

VTU ORIGINAL PG SCHEME

SOLID WASTE ENGINEERING AND MANAGEMENT

Subject Code **: 14 CEE-14**	IA Marks: 50
No. of Lecture Hrs/ Week: 04	Exam Hr: 03
Total no. of Lecture Hr: 50	Exam Mark: 100

Objectives: To provide detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes, while focusing on key engineering and technical aspects involved. Understanding of the basic principles of waste and resource management will be supplemented, where appropriate, by practical problem-solving exercises in the context of civil engineering.

Course Outcomes: On completion of this course, students are able to

- Understand and apply the basic scientific and sustainability principles behind waste management, for solving practical waste management challenges
- Understand the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of value from waste
- Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.

Land pollution and control: Land Pollution sources and their impacts, general control measures.
Solid waste – Sources, Engineering classification, Characterization, Generation and Quantification.
Transport - collection systems, collection equipment, transfer stations, collection route optimization.(10 hr)

Treatment methods: Methods of refuse processing, recovery, recycle and reuse, composting – aerobic and anaerobic, incineration, pyrolysis and energy recovery. (10 hr)

Disposal methods: Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.(10 hr)

Recent Developments in Solid Wastes Reuse and Disposal: Power Generation, Blending with construction materials and Best Management Practices (BMP), Role of various organizations in Solid Waste Management – Governmental, Non-Governmental, Citizen Forums.(10 hr)

Biomedical Waste management: Biomedical (Handling and Management) Rules 2008 ,sources, treatment and disposal (10 hr)

REFERENCES

1. Tchobanoglous G., Theissen H., and Eliassen R., **"Solid Waste Engineering - Principles and Management Issues"**, McGraw Hill, New York.
2. Pavoni J.L., "**Handbook of Solid Waste Disposal**".
3. . Mantell C.L.,, "**Solid Waste Management**", John Wiley.
4. CPHEEO, Manual on Municipal Solid waste management, Jain Book Agency, c-9, Connaught place, New Delhi
5. Sasikumar and Krishna S. G, Solid waste Management, PHI Learning Pvt Ltd, New Delh

6. WHO Manual on Solid Waste Management.
7. 8. Hazardous waste (management and handling) Rules, 2001
9. Biomedical (Handling and Management) Rules 2008

VTU ORIGINAL PG SCHEME

ADVANCED COMPUTATIONAL METHODS AND OPTIMIZATION

Subject Code**: 14 CEE-151**	IA Marks : 50
No. of Lecture Hrs/ Week: 04	Exam Hr: 03
Total no. of Lecture Hr.: 50	Exam Mark: 100

Objectives: To understand the fundamentals of applied optimization, develop competence in formulating optimization models and translating problem descriptions into mathematically solvable models. Learn systems techniques including linear programming, integer, stochastic, and dynamic programming.

Course Outcomes: On completion of this course, students are able to

- Understand systems analysis concepts and techniques applied to engineering problems
- Effectively communicate systems methods and modeling results
- Solve challenging engineering problems that involve constrained resource allocation.

Numerical Methods - Partial differential equations, Newton-Raphson method,
Finite difference, finite element, method of characteristics, different methods, Successive over relaxation methods. (10 hr)

Optimization – classification and importance in Environmental Studies. Single and multivariable optimization without and with constraints.(10 hr)

Linear Programming – different methods, linear approximation of non-linear optimization.(10 hr)

Statistics - Significance Tests **,** Frequency Distribution, Characteristics of Distributions, Method of Least Squares and Regrssion, Multiple Regression (10 hr)

Probability – Concepts, Methods, Binomial, Poisson and Normal distribution, Risk and uncertainty analysis (10 hr)

REFERENCES

1. Rao. S.S." **Optimization: Theory & Applications Techniques**, Wiley Eastern Ltd New Delhi.
2. Taha H.A., "**Optimization Research":An introduction**, Pear son Prentice Hall, 8th Edition
3. Shanthakumar M.S., **Numerical Methods and Analysis,** Tata McGrawhill Pubs.
4. Ross S.M.,"**Introduction to Probability and Statistics for Engineers and Scientists"**, John Wiley Publications.3rd Edition, Acedimic press
5. Stanton R.G –" **Numerical methods for science and engineers"**.Prentice Hall, Trade Edition
6. Kreyszig Erwin " **Advanced Engineering Mathematics"**, Wiley Eastern Publications.
7. Berthouex P.M.,and Brown L. C., "**Statistics for Environmental Engineers"**, Lishers publication,

VTU ORIGINAL PG SCHEME

OCCUPATIONAL SAFETY AND HEALTH

Subject Code **: 14 CEE-152**	IA Marks : 50
No. of Lecture Hrs/ Week: 04	Exam Hrs: 03
Total no. of Lecture Hrs: 50	Exam Marks: 100

Objectives: To identify risks, link to individual behaviors, evaluate precautions and preparations, identify correct processes and procedures, identify critical points, improve decision making

Course Outcomes: On completion of this course, students are able to

- Contribute to the development and maintenance of a healthy and safe work environment
- Interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces
- Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards
- Collect, manage, and interpret information and data to identify trends and issues in the workplace
- Design, support, and evaluate health and safety programs and implement procedures using project management principles and processes appropriate to the task
- Affect/manage change by advancing OH&S principles within management systems, cultures, practices, and priorities.

Introduction: Occupational Safety and Health Act, Occupational Safety and Health Administration, Right to know Laws.
Indian Acts – Labour Act, Factories Act, OSHA (10 hr)

Ergonomics: need, Task Analysis, Preventing Ergonomic Hazards, Ergonomics Programme.
Accident – Causation, investigation methods and different models.(10 hr)

Occupational Hazard and Control: Hazard Analysis, Human Error and Fault Tree Analysis, Emergency Response. Hazards and their control in different manufacturing and processing industries.(10 hr)

Fire Prevention and Protection: Types of Fire, Fire Development and its Severity, Effect, Extinguishing Fire, Electrical Safety, Product Safety.(10 hr)

Occupational Health: Health and Safety Considerations, Personal Protective Equipment.
Health problems in different types of industries – construction, textile, steel and food processing, pharmaceutical, occupational Health and Safety considerations in Wastewater Treatment Plants.(10 hr)

REFERENCES

1. Goetsch D.L., "**Occupational Safety and Health for Technologists**", Engineers and Managers", Prentice Hall.
2. Heinrich H.W., **"Industrial Accident Prevention",** McGraw Hill Publication , Newyork.
3. Colling D.A., "**Industrial Safety Management and Technology**", Prentice Hall, New Jersey.
4. Della D.E., and Giustina, "**Safety and Environmental Management**", Van Nostrand Reinhold International Thomson Publishing Inc.
5. CPHEEO, **Manual on Sewerage and Sewage Treatment, M/s.Jain Book Agency, c-9, Connaught place, New Delhi**i.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., "**Industrial Safety and Pollution Control Handbook**"

VTU ORIGINAL PG SCHEME

REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING

Subject Code: **14 CEE-153**	IA Marks: 50
No. of Lecture Hrs/ Week: 04	Exam Hrs: 03
Total no. of Lecture Hrs: 50	Exam Marks: 100

Objectives: It is aimed at students looking to gain a sound appreciation of the principles and practice of Remote Sensing and how to use it to help address important societal monitoring requirements and science questions. It develops a strong interdisciplinary understanding of critical perspective on Remote Sensing and its role in monitoring the environment. It provides understanding of how Remote Sensing data can be combined with and used in wider environmental modeling.

Course Outcomes: On completion of this course, students are able to

- Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.
- Understand the range of available Remote Sensing technologies and be able to match these to particular kinds of scientific and management problem
- Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider role of Remote Sensing in environmental modeling and monitoring.

FUNDAMENTALS OF REMOTE SENSING

Definition, Physics of Remote Sensing, Electromagnetic Radiation and its interactions with atmosphere, Spectral reflectance of earth features, Resolution Spectral, Spatial, Temporal and Radiometric. (10 hr)

PLATFORMS SENSORS AND IMAGE PROCESSING

Aerial Photographs, Active and passive sensors, Data products, Various satelites in orbit and their sensors. Image Processing – Visual and digital image, Interpretation, Interpretation keys, Methodology, Training sets, Ground truth verification, Image analysis, Image enhancement, Rectification, Classification methods, Users accuracy, Producers accuracy and overall accuracy. (10 hr)

INTRODUCTION TO GIS

Data entry, storage and maintenances, Data output. Data analysis, Hardware and software.(10 hr)

APPLICATIONS OF REMOTE SENSING AND GIS

Applicaions of remotely sensed data for identifying solid waste disposal, forest fire mapping, EIA studies etc., Optimal routing of solid waste using GIS – Case study, Environmental siting of industries and zoning atlas development, Remodeling of water distribution system using GIS, Environmental degradation assessment using RS and GIS. (20 hr)

References

1. Lillies and T.M. and Kiefer, R.W., **"Remote Sensing and Image Interpretation"**, John Wiley and Sons,
2. Burrough, P.A. and McDonnell, R.A., **"Principles of Geographical Information Systems",** Oxford University Press, .
3. Lintz, J. and Simonet, "**Remote Sensing of Environment**", Addison Wesley Publishing Company,
4. Mishra H.C., **"GIS Hand Book"**, GIS India, Shanthi Nivas, Hyderabad.
5. Syed R. Qasim , Edward M. Motley & Guang Zhu, **"Water Works Engineering: Planning, Design And Operation",** Eastern Economy Edition, PHI Learning Private Limited, New Delhi.

VTU ORIGINAL PG SCHEME

COMPUTER APPLICATIONS LABORATORY OF ENVIRONMENTAL SYSTEMS - I

Subject Code : **14CEE16**	IA Marks : 25
No. of Practical Hours/ Week : 03	Exam Hours : 03
Total Practical Hours : 42	Exam Marks : 50

Introduction to DOS & UNIX operating system environment along with file handling commands (like- open, copy, rename, delete etc.)

I. Writing programmes in C-language & Running for the following.

1) Exercises on data sorting and searching, matrix operation, numerical Integration and curve fitting.
2) Exercises on statistical analysis of data – mean, median, std. Deviation & variance for grouped and ungrouped data.
3) Population forecast: AM, GM, incremental and logistic curve method.
4) Rising main design, pumping UNIT design and water distribution system (two to three loops).
5) Design of water treatment units – Cascade aerator & Spray aerator, Plain Sedimentation tank, Clariflocculator tank, Filters (rapid and slow) – Mechanical rapid mix unit.
6) DO model for river (streeter – phelps) and lake, river mixing zone water quality – critical point method.

II. Running following application software packages:

a. WAT PLANT and DOWATTS for treatment units.

b. WADISO, BRANCH, LOOP, QUALOOP and EPANET for water Distribution system.

c. RMAIN - water rising main design.

d. SEWER – sewer network design.

e. WRPLOT (USEPA) – Wind rose plot

f. ISCST / ISCLT (USEPA) versions air quality predictions from industrial sources.

g. CALINE (USEPA) versions model for air quality near Highways.

REFERENCES

1. **Manual on water supply and Treatment**, CPHEEO, Ministry of Urban Development, GoI,New Delhi, 1999.
2. **"Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development,GoI, New Delhi,
3. **Software Package Manual on BRANCH, LOOP, SEWER –** UNDP/UNEP.
4. **WATPLANT and QUALOOP Softwares**. **–** CPHEEO – Manual.
5. **Relevant Software Manuals–** USEPA
6. Wark.K, Warner G.F. and Davis W.T **– Air Pollution its origin and control**, Addison-Wesley,
7. Thomann R.V and Mueller J.A **–**. **Principles of surface water quality modeling and control**, Harper & Row Publishers,
8. Sincerio A.P.& Sincerio G.A.)**–**, **Environmental Engineering – A Design Approach** Prentice Hall of India.

VTU ORIGINAL PG SCHEME

II SEMESTER

ATMOSPHERIC ENVIRONMENTAL POLLUTION AND CONTROL

Subject Code **: 14 CEE-21**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

Objectives:

- Introduction of major problems in indoor air pollution and control, regulations
- Describe general air pollution problems, meteorological definitions, air transport equations and pollution control matters and devices.

Course Outcomes: On completion of this course, students are able to

- Identify anthropogenic sources and atmospheric effects to pollutions
- Understand Regional, global pollution transport mechanisms
- Appreciate development of transport equations and applications, stack

Learn theory and development of pollution control devices: Cyclone, electrostatic particle precipitator, packed towers, gravitational separator, bag house.

Introduction: sources, effects on **–** ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance.(10 hr)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Windrose diagram.(10 hr)

General characteristics of stack emissions, plume behaviour, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources.
Monitoring of particulate matter and gaseous pollutants – respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.(10 hr)

Air Pollution Control equipment for particulate matter & gaseous pollutants – gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostaticprecipitator (ESP).
– adsorption, absorption, scrubbers, condensation and combustion.(10 hr)

Indoor Air Pollution – sources, effects and control.
Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.(10 hr)

REFERENCES

1. Wark K ., Warner C.F., and Davis W.T., "**Air Pollution - Its Origin and Control**", Harper & Row Publishers, New York.
2. Lee C.C., and Lin S.D., **"Handbook of Environmental Engineering Calculations**", McGraw Hill, New York.
3. Perkins H.C., "**Air Pollution**", McGraw Hill.
4. Crawford M., "**Air Pollution Control Theory**", TATA McGraw Hill.
5. Stern A.C., "**Air Pollution**", Vol I, II, III.
6. Seinfeld N.J.,, "**Air Pollution",** McGraw Hill.
7. Stern A.C.) Vol. V, "**Air Quality Management**".
8. M N Rao and HVN Rao, Air Pollution" Tata Mc Graw Hill publication

VTU ORIGINAL PG SCHEME

ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

Subject Code **: 14 CEE-22**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

Objectives: The course introduces process of environmental impact assessment and policy decision making as required under the National Environmental Policy Act (NEPA) and the regulations of the Council of Environmental Quality (CEQ). Topics include identification of purpose and need for any actions affecting the environment, development of objectives and decision criteria, and various techniques for assessing impact and comparing alternatives for a given environmental intervention. The strengths and weaknesses of various approaches are evaluated with techniques that allow analysis of multiple objectives and conflicting uses of environmental resources
The goals of this course, in addition to gaining an understanding of the discipline of ecology, include developing and improving skills in scientific writing, basic mathematics, statistics, and in the use of computer spreadsheets.

Course Outcomes: On completion of this course, students are able to

- Develop an appreciation of the modern scope of scientific inquiry in the field of Ecology
- Become familiar with the variety of ways that organisms interact with both the physical and the biological environment
- Develop an understanding of the differences in the structure and function of different types of ecosystems
- Appreciate the purpose and role of EIA in the decision-making process
- Understand the strengths of EIA in regard to environmental management
- Understand the technical and social/political limitations of EIA
- Know the administration and procedures that apply in the student's jurisdiction
- Understand the screening process
- Understand the scoping process and how it is applied
- Know the options for estimating environmental and social impacts
- Know the format of an EIA Report (Environmental Impact Statement, or Environmental Statement)
- Appreciate the factors that assist, and detract, from the usefulness of the EIA Report
- Understand the purpose of developing follow-up procedures, and the options for designing these procedures

Ecology: Classification of Ecosystems, Structure and Function of Ecosystems, Energy flow in Ecosystems, Ecological Niche and succession, Bio-geo-chemical cycles, Ecological Pyramids. **(10** hr**)**

Aquatic and Terrestrial Ecosystems: Diversity and dominance Indices, Ecosystem Models.
Climate change and biodiversity

Lake Ecosystem:Trophic levels, nutrient loading, nutrient enrichment, Leibig's Law, control of eutrophication.(10 hr)

Environmental Impact Assessment: Definition, Objectives, Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by-step procedure for conducting EIA and Limitations of EIA, Prevention of Significant
Deterioration (PSD) Programme. Carrying capacity concept (10 hr)
Frame work of Impact assessment: Scope and contents of EIA, methodologies and techniques of EIA.

Attributes, Standards and Value functions:. Public participation in EIA. Environmental Management Plan (EMP) and Disaster Management Plan (DMP).(10 hr)

EIA Case Studies –Thermal Power Plant, Mining, Fertilizer, Construction Projects, Air port, Water and Wastewater Treatment Plants.(10 hr)

REFERENCES

1. Kormondy, , "**Concepts of Ecology**", Prentice Hall Publication, New Jersey.
2. Odum, "**Fundamentals of Ecology",** Adisson Co.
3. Krebs J., "**Ecology - The Experimental Analysis of Distribution and Abundance**", I Edition, Harper International.
4. Hall C.A.S., and Day J.W., "**Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories**", John Willey.
5. Canter L., , "**Environmental Impact Assessment**", McGraw Hill.
6. Jain R.K., Urban L.V., Stacey G.S., , "**Environmental Impact Analysis – A New Dimension in**

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Decision Making", Van Nostrand Reinhold Co.
7. Clark B.C. Bisett and Tomlinson P, "**Perspective on Environmental Impact Assessment**", Allied Publishers.
8. Rau and Wooten, "**Environmental Impact Assessment Handbook**". McGraw Hill.
9. **Relevant Journals** :

VTU ORIGINAL PG SCHEME

WASTEWATER TREATMENT ENGINEERING

Subject Code **: 14 CEE-23**	IA Marks : 50
No. of Lecture Hrs/ Week: 04	Exam Hrs : 03
Total no. of Lecture Hrs.: 52	Exam Marks : 100

Objectives: To provide a basic description and understanding of the principal unit processes used in the treatment of wastewater. This will include coverage of the scientific basis of each unit process, as well as the conventional approach to their engineering design. In the area of wastewater treatment the course will provide an understanding of the kinetic theory of biological growth and apply it to typical aerobic processes, and an appreciation of the purpose and practice of sludge treatment.

Course Outcomes: On completion of this course, students are able to understand

- A process flow sheet.
- Appropriate treatment methods for municipal and certain industrial effluents.
- How water and wastewater treatment plants operate.
- Simple design equations for water and wastewater treatment plant.
- The chemical and biological procíples behind unit processes used in water and wastewater treatment unit processes.
- The concept of a unit operation and a unit process.
- The fundamental scientific processes underlying the design and operation of wastewater treatment plant.
- The management of residuals from water and wastewater treatment.
- The methods that are used for the design of a water and wastewater treatment plant.
-

Objectives of wastewater treatment: Characteristics, flow variations, types of reactors and reactors analysis. Wastewater Treatment Flow Diagrams and Hydraulic Profile.

Kinetics of biological treatment systems: Biokinetic constants and their determination, batch and continuous systems.(10 hr)

Theoretical principles and design: screens, equalization basin, grit chamber, primary and secondary settling tanks.(10 hr)

Theoretical principles and design:Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors. Principles and design of stabilization ponds (10 hr)

Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Wastewater disinfection.(10 hr)

Sludge Processing: Separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic.

Rural wastewater systems: Septic tanks, two-pit latrines, eco-toilet, soak pits.(10 hr)

REFERENCES

1. Benefield R.D., and Randal C.W., , **"Biological Process Design for Wastewater Treatment"**, Prentice Hall, Englewood Chiffs, New Jersey.
2. Metcalf and Eddy Inc., , **"Wastewater Engineering - Treatment and Reuse",** 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Karia G.L., and Christian R.A., **"Wastewater Treatment Concepts and Design Approach",** Prentice Hall of India Pvt. Ltd., New Delhi.
4. Ronand L., and Droste, ,"**Theory and Practice of Water and Wastewater Treatment**", John Wiley and Sons Inc.
5. Fair G.M., Geyer J.G and Okun, "**Water-wastewater Engineering**".
6. Lee C.C., and Lin S.D., **"Handbook of Environmental Engineering Calculations",** McGraw Hill, New York.
7. Gaudy, "**Advanced Wastewater Treatment".**
8. **"Industrial Safety and Pollution Control Handbook",** National Safety Council and Associate (Data) Publishers Pvt. Ltd.,

VTU ORIGINAL PG SCHEME

TRANSPORT PROCESSES AND MODELLING OF AQUATIC SYSTEMS

Subject Code **: 14 CEE24**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

Objectives: To make students learn evaluation and control techniques of water quality management in streams, lakes, and estuaries. Mathematical analyses of patterns of water movement and their relation to water quality. Fate and transport of contaminants in natural aquatic systems, design and management of environmental and water resource systems,

Course Outcomes: On completion of this course, students are able to understand

- Contaminant transport and fate
- Ecological and human effects assessment
- Environmental decision criteria
- Monitoring strategies
- Environmental exposure assessment

Development of pollutant transport, fate and persistence models; model parameter estimation.

Modelling: Introduction, applications in environmental management. **Physical phenomena** – advection, diffusion, dispersion, Fick's laws of diffusion and convective - diffusion equations for turbulent & shear flow regimes.(10 hr)

Steady-state water quality modeling: Models for conservative and non-conservative substances.
Data collection and analysis - specialized water quality surveys,estimation of decay and reareation rates.(10 hr)

1-D Oxygen balance models: Streeter-Phelps equation, critical point method.
Calibration and verification of 1-D oxygen model. Error measures.(10 hr)

Mixing zones in rivers: Types of outfalls and mixing regimes. Steady-state 2-D analysis. Field study methodology. Parameter estimation – lateral mixing co-efficient - critical point method – simple numerical problems. Dissolved oxygen models for lakes under completely mixed and stratified conditions.(10 hr)

Eutrophication models: Simplified nutrient loading models for rivers and lakes.
Ocean disposal of wastewater: Siting and design of outfalls.
Ground water quality modeling concepts: Formulation 1-D & 2-D models with decay and retardation for instantaneous sources, plume delineation studies (10 hr)

REFERENCES

1. Rich L.G., **"Environmental Systems Engineering",** McGraw Hill.
2. Thomann R.V., and Mueller J.A., **"Principles of Water Quality Management and Control"**, Harper & Row Publications.
3. Schnoor J.L., **"Environmental Modelling – Fate and Transport of Pollutants in Water, Air and Soil"**, John Wiley and Sons.
4. Thomann R.V., **"Systems Approach to Water Quality Management"**, McGraw Hill.
5. Lee C.C., and Lin S.D., **"Handbook of Environmental Engineering Calculations"**, McGraw Hill, New York.

VTU ORIGINAL PG SCHEME

ENVIRONMENTAL PLANNING AND MANAGEMENT

Subject Code **: 14 CEE-251**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

Objectives: To introduce the basic knowledge of current environmental management systems applied in both public and private sectors. Class discussions will cover conventional development of ISO 14001 Environmental Management Systems (EMS) for various levels of organizations. Possible extensions of internal and external environmental auditing, environmental label, and life cycle assessment can be made based on relevant Total Quality Environmental Management (TQEM) requirements. Case studies emphasize enterprise strategic environmental management planning for organizations and their stakeholders, in the context of environmental regulatory, law and policy. The topics are linked with ecoproduct evaluation, environmental performance evaluation, and green production planning to search for strategies compatible with ISO 14001-accreditation.

Course Outcomes: On completion of this course, students have

- A sound understanding of the principal environmental policy issues confronting managers in diverse geographical and culture situations
- An awareness of the ethical and moral issues involved in seeking the wise and sustainable use of resources
- A range of relevant practical skills, particularly in the fields of impact assessment, audit and law

Environment and Sustainable Development: Carrying capacity, relationship with quality of life, carrying capacity and resource utilization.

Engineering Methodology in Planning and its Limitations: Carrying capacity based short and long term regional planning.(10 hr)
Environmental Protection: Economic development and social welfare consideration in socio economic developmental policies and planning.

Total cost of development and environmental protection cost.: Case studies on Regional carrying capacity.**(10** hr**)**

Engineering Economics: Value Engineering, Time Value of Money, Cash Flows, Budgeting and Accounting.(10)

Environmental Economics: Introduction, economic tools for evaluation, Green GDP, Cleaner development mechanisms and their applications.(10 hr)

Total Quality Management in environmental management and protection – ISO 9000, 14000 and 18000 series of standards. **Environmental Audit** – methods, procedure, reporting and case studies.(10 hr)

REFERENCES

1. Lohani B.N , "**Environmental Quality Management**",South Asian Publishers, New Delhi
2. Chanlett,)"**Environmental Protection**", McGraw Hill Publication, Newyork.
3. Danoy G.E., and Warner R.F., "**Planning and Design of Engineering Systems**",Unwin Hyman Publications.
4. MOEF, Government of India, "**Carrying Capacity Based Developmental Planning Studies for the National Capital Region"**, 1995-96.
5. NEERI, Nagpur, Annual Reports 1995 & 1996.
6. UNEP / UNDP – "**Environmental Sustainable Development**".

VTU ORIGINAL PG SC(F)

HAZARDOUS WASTE MANAGEMENT

Subject Code**: 14 CEE-252**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

Objectives: To provide an understanding of hazardous waste engineering principles and management issues, Waste sources, characteristics, generation, collection, transfer and transport, Waste recycling, reuse, recovery, treatment and disposal. This course is designed to provide students with the necessary background and knowledge pertaining to the engineering design of hazardous waste facilities.
Course Outcomes: On completion of this course, students are able to

- Build knowledge of hazardous materials and wastes with respect to definitions, regulations, communication of health effects, prioritization and prevention of releases, response to releases, emissions to soil, air and water, transportation, treatment, disposal, storage, and minimization.
- Build problem solving and communication skills for managing hazardous materials and wastes, particularly in terms of recognizing dangerous situations, prioritizing and recommending management actions, and writing and speaking clearly about problems and solutions.
- Apply knowledge and problem solving and communication skills to specific problems in order to practice the role of health and safety professionals in managing hazardous materials and wastes.

Introduction, Sources, Classification: Regulations for Hazardous Waste Management.
Hazardous Waste Characterization, Designated Hazardous Wastes.(10 hr)

Waste Minimization and Resource Recovery: Approaches, Development of a Waste Tracking System, Selection of waste Minimization Process, Case Studies.(10 hr)

Transportation of Hazardous Waste: Requirements, regulations, containers, bulk and non-bulk transport, Emergency Response.(10 hr)

Physico-chemical, Chemical and Biological Treatment of hazardous waste.
Thermal treatment - Incineration and pyrolysis.(10 hr)

Sanitary landfill: Design approach, leachate and gaseous collection system. Facility Siting and Process Selection for treatment, storage, disposal facility (TSDF).
Soil contamination and site remediation: Bioremediation processes, monitoring of disposal sites.(10 hr)

REFERENCES

1. Lehman, **"Hazardous Waste Disposal"**, Plenum Press.
2. LaGrega M.D., Buckingham P.L., and Evans J.C.,, **"Hazardous Waste Management**", McGraw Hill International Edition.
3. Wentz C.A., , "**Hazardous Waste Management**",. ", McGraw Hill International Edition.
4. Dawson and Mercer, , **"Hazardous Waste Management**", John Wiley.
5. Fawcett, "**Hazardous and Toxic Materials: Safe Handling and Disposal"**, John Wiley.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., "**Industrial Safety and Pollution Control Handbook"**

VTU ORIGINAL PG SCHEME

GLOBAL WARMING AND CLIMATE CHANGE

Subject Code	**: 14 CEE-253**	IA Marks : 50
No. of Lecture Hrs/ Week	: 04	Exam Hrs : 03
Total no. of Lecture Hrs.	: 50	Exam Marks : 100

Objectives: To provide an understanding of the factors responsible for climate change, the biological and sociological consequences of such changes; and the possible engineering, economic, and legal solutions to avoid more extreme perturbations.

Course Outcomes: On completion of this course, students are able to

- Measure climate factors and how they change
- Understand connections between global warming and human activities
- Identify effects of climate change on biodiversity and ecosystems in different biomes and aquatic systems
- Model possible scenarios for future climate change
- Achieve possible ways to deal with climate change.

Energy Issues and Climate Change , Alternate Energy Sources (10 hr)
Green-House Effect as a Natural Phenomenon, Green House Gases GHGs) and their Emission Sources Quantification of CO_2 Emission, Global Warming Potential (GWP) of GHGs (10hr)

Modeling Climate change, Ozone layer depletion and its control,

Impacts of climate change: Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Coastal Flooding, Wetlands and Estuaries loss Impact of ocean current on global climate, EL-NINO & LA-NINA effects (10 hr)

Kyoto Protocol: Importance, Significance and its role in Climate Change
Carbon Trading - Mechanisms , Various Models (European, Indian) Global and Indian Scenario (10 hr)

Cleaner Development Mechanisms: Various Projects related to CO_2 Emission Reduction
Alternatives of Carbon Sequestration: Conventional and non-conventional techniques , Role of Countries and Citizens in Containing Global Warming (10 hr)

References

1. Barry R.G., and Chorley R.L., **"Atmosphere, Weather and Climate",** 4th Edition, ELBS Publication.
2. Bolin B., (Ed.), **"Carbon Cycle Modelling",** John Wiley and Sons Publications.
3. Corell R.W., and Anderson P.A., (Eds.), **"Global Environmental Change",** Springler Verlog Publishers.
4. Francis D., **"Global Warming: The Science and Climate Change",** Oxford University Press.
5. Frame B., Medury Y., and Joshi Y., (Eds.), **"Global Climate Change: Science, Impact and Responses".**
6. Linden E.,, **"The Winds of Change: Climate, Weather and the Destruction of Civilizations",** Simon and Schuster Publications.
7. Mintzer I.M., (Ed.), **"Confronting Climate Change, Risks, Implications and Responses"**, Cambridge University Press.
8. Srivatsava A.K., **"Global Warming",** APH Publications.
9. Wyman R.L., (Ed.), , **"Global Climate Change and Life on Earth",** Chapman and Hall Publications.
10. Yadav, Chander and Bhan, **"Global Warming: India's Response and Strategy",** RPH Publications.

VTU ORIGINAL PG SCHEME

COMPUTER APPLICATIONS LABORATORY OF ENVIRONMENTAL SYSTEMS - II

Subject Code : **14CEE26** IA Marks : 25
No. of Practical Hours/ Week : 03 Exam Hours : 03
Total Practical Hours : 42 Exam Marks : 50

Writing programmes in C-language & Running for the following.

1) Design of wastewater Collection units – Sewer network analysis and design.
2) Design of wastewater treatment units – Septic tank, Screen, Grit chamber, Secondary settling tank, ASP, Trickling filter, Waste stabilization pond, Oxidation ditch, Sludge digester, Sludge drying beds.
3) Design of Sanitary Landfill for Municipal Solid Waste Disposal with leachate & gas collection systems.
4) GIS Operations – Spatial Data Input, Data Management Display, Exploration analysis & GIS Modeling.
5) Air quality system: Gaussian Plume model for gaseous and particulate dispersion, effective stack height determination and particulate control devices design.
6) Introduction to computer graphics – Applications.
7) Introduction to Database Management Systems.

REFERENCES

1. **Manual on water supply and Treatment**, CPHEEO, Ministry of Urban Development, GoI,New Delhi, 1999.
2. CPHEEO **"Manual on Sewerage and Sewage Treatment**",, M/s. Jain Book Agency, C-9, Connaught place, New Delhi,
3**.Software Package Manual on BRANCH, LOOP, SEWER –** UNDP/UNEP.
4. **WATPLANT and QUALOOP Softwares**. **–** CPHEEO – Manual.
5. **Relevant Software Manuals–** USEPA
6. Wark.K, Warner G.F. and Davis W.T **– Air Pollution its origin and control**, Addison-Wesley,
7. Thomann R.V and Mueller J.A)**–**. **Principles of surface water quality modeling and control**, Harper & Row Publishers,
8. Sincerio A.P.& Sincerio G.A.**–**, **Environmental Engineering – A Design Approach** Prentice Hall of India.

VTU ORIGINAL PG SCHEME

IV SEMESTER

INDUSTRIAL WASTEWATER TREATMENT

Subject Code **: 14 CEE-41**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 52	Exam Marks : 100

Objectives: To provide an understanding of the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic industrial or commercial activities prior to its release into the environment or its re-use. To understand various terms used in industrial wastewater treatment and to acquaint with different steps involved in treatment of industrial wastewater.

Course Outcomes: On completion of this course, students are able to

- Learn physical/chemical/biological characteristics of and the evaluation technique for various industrial wastewater
- Understand the theory, engineering application, and design technique for the industrial wastewater treatment unit processes.

Effects of Industrial Wastes on sewerage system and sewage treatment plants and receiving water bodies. Effects of waste additions on physical and chemical properties of soil.
Effluent standards and receiving water quality standards. Different aspects and choices of various disposal alternatives.(10hr)

Industrial Waste survey-Process flow charts, condition of waste stream. Material balance, Sampling – Grab, Composite and integrated samples. Continuous monitoring – pH, Conductivity, Biomonitoring.(10 hr)
Pretreatment of Industrial Wastewater – Volume reduction, Strength reduction, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids.

Wastewater Treatment in specific industries: Distrillery, Sugar, Pulp and paper, Cement, Textile, Dairy, Fertilizer, Pesticides, Pharmaceutical, (10hr)
Design of complete treatment system & disposal for industries: Distillery, Diary, Textile, paper and pulp mill to meet P.C.B. norms.

Radio Active Wastes treatment- Low activity and high activity radiation, application of radio active techniques for wastewater treatment. **Bio-Remediation** of contaminated soils. (10hr)

Environmental Auditing: Introduction, Cost of Pollution, Environmental audit solutions, Financial and Managerial opportunities. Criminal and Regulatory liabilities.(10hr)

REFERENCES

1. Nemerow N.N., "**Liquid Waste of industry theories,** "Practices and Treatment. Addison Willey New York.
2. Azad N. S.,– "**Industrial Wastewater Management Hand Book"** McGraw Hill book Co., Newyork.
3. Ross R.D. "**Industrial Waste Disposal"**, Reinhold Environmental Series – New York.
4. Dickinson" **Practical Waste Treatment and Disposal Applied Science publication**, London.
5. Mahajan," **Pollution control in Process industries"**. TMH, New Delhi.
6. Eckenfelder, "**Industrial Water pollution Control"-** McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA
7. **Bioremediation books**

VTU ORIGINAL PG SCHEME

NON – POINT SOURCES OF POLLUTION AND MANAGEMENT

Subject Code **: 14 CEE-421**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 52	Exam Marks : 100

Objectives: To provide an understanding to protect the quality of water resources from the adverse effects of nonpoint source (NPS) water pollution. Types of regulated point sources include wastewater treatment facilities, municipal storm water systems, and concentrated animal feeding operations. NPS pollution occurring from rainfall flows off the land, roads, buildings, and other features of the landscape are discussed in the modules.

Course Outcomes: On completion of this course, students are able to

- Utilize Simulation Models for tracing nonpoint source pollution
- Develop management solutions for nonpoint source pollution control
- Select best management solutions for nonpoint source pollution control

Introduction: Non-point Pollution, Problem, definitions, magnitude of Non-point Pollution, Non-point Pollution Control Laws, Waste Assimilative Capacity and Stream Standards
Pollution From the Atmosphere: Atmospheric Inputs – fall out, rainfall, Overland routing of the precipitation excess, interflow ground water flow.(10 hr)

Groundwater Pollution: Sources of Groundwater Contamination, Groundwater Movement.
Pollution from impervious urban areas: Introduction Deposition and Accumulation of Pollutants on Impervious Surfaces
Removal of Solids from street Surfaces, Porous Pavement. .(10 hr)

Non point Pollution Simulation Models: Basic Concepts Brief Description available Nonpoint Pollution Simulation Models.(10 hr)

Land use and non-point pollution: Effects , Comparative Assessment of Pollution Impact from land use, agricultural runoff, mining area runoff, Effect of hydrologic Modifications
Management Practices of Non-point pollution control: Introduction, Source Control Measures Collection Control and Reduction of Delivery.(10 hr)

Planning for Nonpoint Pullution Control: Introduction, Water Quality Planning Process, Selection of Best Management Practices for Non Point Source Pollution Control – detention ponds, exfiltration and infiltration trenches, vegetative swales. .(10 hr)

REFERENCES

1. Novotny V., and Chesters G., " **Hand Book of Non-point Pollution, Sources and Management",** Van Nostrand Reinhold Environmental Engineering Series, New York.
2. Pavoni J L, (Ed) "Hand Book of **Water Quality Management Planning"**, Van Nostrand Reinhold, Environmental Engineering Series.New York
2. Pluarg, Pollution from Land Use Activities Reference Group Novotny V and Chesters G, , "**Hand Book of Non-point Pollution, Sources and Management"**, Van Nostrand Reinhold Company.

VTU ORIGINAL PG SCHEME

ADVANCED ATMOSPHERIC ENVIRONMENTAL ENGINEERING

Subject Code **: 14 CEE-422**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

Objectives: Course introduces Atmospheric Processes and Chemical Reactions, Characteristics of atmospheric boundary layer and its depth. It enlightens students on Urban Air Quality Simulation Modeling and its inherent problems, dispersion of Heavy Gases, design of Industrial Ventilation Systems.

Course Outcomes: On completion of this course, students are able to

- Understand Atmospheric Processes and Chemical Reactions
- Effectively utilize knowledge of design on Industrial Ventilation Systems

Learn Urban Air Quality Simulation Modeling

Atmospheric Processes and Chemical Reactions: Definition of terms aerosols, particle, photolysis, gas to particle conversion, condensation, evaporation, dissolution, sublimation, specific heat, conduction, radiation. Mechanical turbulence, forced convection, advection, equation of state, first law of thermodynamics. Reaction Rates (Gas Phase Species) Atmospheric gases and their molecular structures, chemical reactions and photo processes, reaction rates, reaction rate coefficients, sets of reactions, stiff systems.(10hr)

Atmospheric Boundary Layer: Characteristics of atmospheric boundary layer-boundary layer depth, mean velocity power-law profile, Log-Log velocity profile, spectral description of turbulence, turbulence intensity, Reynolds stress parameter, spectral density function, integral length scale, inertial subrange and small scales. Turbulent fluxes of momentum, turbulent fluxes of energy and water vapour, friction velocity, surface roughness lengths, bulk aerodynamic equations for eddy diffusion, monin-obukhov
similarity theory, eddy diffusion above the surface layer, ground surface temperature and moisture. .(10hr)

Urban Air Quality Simulation Modeling: General need, alternative approaches, basic model applications, general composition of models, Numerical modeling approaches-Gaussian diffusion models, physical basis of the mass conservation approach, mathematical foundation of the mass conservation approach. .(10hr)

Inherent problem in air quality simulation modeling: Boundary conditions, spatial resolution and compatibility with available data. Transportation related modeling-street canyon models, highway models, airport models. Air quality simulation models for Quasi-Inert pollutants-sulfur dioxide and particulate models, carbon monoxide models. Air quality simulation models for photochemical pollutants-background, features of photochemical air quality simulation models, model evaluation, model validation.

Dispersion of Heavy Gases: Introduction, characteristics of heavy gas flow, introduction to numerical modeling of heavy gas dispersion, requirements for physical models (non-dimensional parameters, choice of scaling variables). .(10hr)

Mobile Sources of Pollution: Introduction, emission standards for automobiles, Gasoline, origin exhaust emissions from gasoline engines, crankcase and evaporative emissions, alternative fuels and their utilization.

Indoor Air Pollution: Introduction, the IAQ problem, diagnosis and remediation of IAQ problems, the interdisciplinary approaches. Industrial hygiene and its application to IAQ, industrial hygiene methodology. Indoor air quality and industrial hygiene, sampling, analysis and interpretation. Industrial hygiene methodology, architectural and construction aspects.

Design of Industrial Ventilation Systems: Introduction, ventilation by dilution, hood specifications, hoods of simple geometry, experimental velocity contours, complex hood design, duct design, fan selection and performance. .(10hr)

VTU ORIGINAL PG SCHEME

REFERENCES

1. Jacobson. Z. A., **Fundamental of Atmospheric modeling,** Cambridge University Press, Cambridge.
2. Warren B. Johnson et. al. , **Air Pollution**, Arthur C. Stern, third edition, Volume I, Academic Press, New York, .
3. Krogstad and Jacobsen, **Dispersion of heavy gases, in encyclopedia of environmental control technologies**, edited by Cheremioinoff, Volume-2, Rulf publishing company, Houston.
4. Crawford Martin**, "Air pollution control theory"**, Tata McGraw- Hill publishing company Ltd. New Delhi, .
5. Stull B. Roland, **Boundary Layer Meteorology**, Kluwer Academic Publishers, .
6. Snyder H. William, "**Guideline for fluid modeling of atmospheric diffusion",** U.S. Environmental Protection Agency research Triangle Park, NC 27711.
7. Wark K., Warner C.F., and Davis. W.T., Air Pollution, "**its origin and control**", Third Edition, Harper and Row Publication.
8. Steve M. Hays, Ronald V. Gobbell & Nicholas R. Ganick, "**Indoor Air Quality"-** Tata McGraw-Hill.

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VTU ORIGINAL PG SCHEME

TOXICOLOGY & ENVIRONMENTAL RISK ASSESSMENT

Subject Code **: 14 CEE-423**	IA Marks : 50
No. of Lecture Hrs/ Week : 04	Exam Hrs : 03
Total no. of Lecture Hrs. : 50	Exam Marks : 100

OBJECTIVES: This course introduces the principles; mechanistic and management about the environmental toxicology. This course comprises :Introduction Environmental toxicology, Toxic-kinetic, Carcinogenic compound, Developmental toxicology, Environmental hormone, Pesticides, Heavy metal, Dioxin, Polychorinated biphenyls (PCBs), Polyaromtic hydrocarbons（PAHs).

Course Outcomes: On completion of this course, students are able to

- Understand various risk assessment methods
- Identify the significance and applications of toxicology
- Learn Ecological risk assessment methods

Introduction to toxicology: Significance, Applications, & Importance (10hr)

Introduction to risk assessment: Assessment methods,
Human exposure assessment, characterization of health risks. LD50 & LC50 concentrations (10hr)

Toxicology: Exposure, toxic effects, dose response relationships, carcinogens and non-carcinogens. (10hr)

Toxicology & Epidemiology: Public health & Risk assessment, Epidemiology & its importance (10hr)

Hazard identification, exposure and toxicity assessment, Risk characterization, risk communication, Ecological risk assessment – Monte Carlo methods, case studies. (10hr)

VTU ORIGINAL PG SCHEME

REFERENCES

1. LaGrega M.D., Buckingham P.L. and Evans J.C., "**Hazardous Waste Management"-** McGraw Hill, New York
2. David G.M, and Haner N.B., "**An Applied Approach to Epidemiology and Toxicology for Engineers"** – Instructor's Resource Guide, US Department of Health Education and Welfare.
3. World Health Organization Report," **Recommended Health Based Limits in Occupational Exposure to Heavy Metals"**
4. Kamrin S. E., "**A text book on Primer on Toxicology Principles & Applications"** Lewis Publishers.
5. Kalos M.H., and Whitloc P.A, **Monte Carlo Methods**, Vol. 1, Basics, Wiley Publications.
6. Fan A.M & Chang L.W, , "**Toxilogy & Risk Assessment- Principles , Methods & Applications",** Informa Health Care pubs.
7. Price F.T, Nancy Lane, Briq K.V, , "**Environmental Toxiology & Risks Assessment** – **Recent Advancement in Environmental Fate & Transport ", ASTM International**
8. Landis W.G., Ming-Ho Yu, "**Introduction to Environmental Toxicology - Impacts of Chemicals upon Ecological Systems", CRC Press**

BMS COLLEGE OF ENGINEERING, BANGALORE – 560 019
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DEPARTMENT OF CIVIL ENGINEERING
M. TECH – ENVIRONMENTAL ENGINEERING - SCHEME 2016-2017

I Semester

CREDIT BASED

Course Code	Name of the Course	Credits				CREDITS
		L	T	P	S	
16CVEN1CCM	Applied Environmental Chemistry & Microbiology	3	0	1	0	4
16 CVEN1CWT	Water Treatment Technology	4	0	0	0	4
16CVEN1CWR	Water Resources Engineering & Applied Hydraulics	3	1	0	0	4
16CVEN1CWW	Wastewater Treatment Engineering	3	0	1	0	4
16CVEN1EXX	Elective - I	3	0	0	0	3
16CVEN1EXX	Elective – II	3	0	0	1	4
16EPIM1CRM	Research Methodology	2	--	--	--	2
Total						**25**

L – Lecture; T - Tutorial; P – Practical ; S – Self Study

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DEPARTMENT OF CIVIL ENGINEERING
M. TECH – ENVIRONMENTAL ENGINEERING - SCHEME 2016-2017

Elective - I		**Elective - II**	
16CVEN1ESC	Statistics and Computational Methods	16CVEN1ERG	Remote Sensing & GIS in Environmental Engineering
16CVEN1ELP	Environmental Legal Aspects And Policy Guidelines	16CVEN1ESW	Solid Waste Engineering and Management
16CVEN1ERF	Renewable Energy and Alternative fuels	16CVEN1EGC	Global warming and climate change

Note : one elective to be chosen from each group of electives :
Elective will be offered for a minimum strength of six candidates (out of 18) / eight candidates (out of 24)

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M. TECH – ENVIRONMENTAL ENGINEERING - SCHEME 2016-2017

I SEMESTER

APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

Course Name	Applied Environmental Chemistry And Microbiology	**Course Code**	16CVEN1CCM	**SEE Duration**	03 Hrs
Credits	**04**	**L-T-P-S**	3-0-1-0	**CIE+SEE**	50+50

Course Objectives: The course provides a in depth knowledge of various branches of Chemistry, microbiology and its application in treatment and characterization of environmental pollutants.

Course Outcomes: On completion of this course, students are able to

CO1: Apply the principles of Physical and Electrochemistry in Environmental engineering.

CO2: Explain the principles of Colloidal and Analytical chemistry in Environmental Engineering process.

CO3: Evaluate water and wastewater quality parameters through experiments.

CO4: Explain basic morphology, metabolism of different microorganisms and its role in ecological and treatment processes.

Introduction: Importance of Environmental Chemistry, types of reactions, redox reactions, reaction kinetics. Physical and equilibrium chemistry – fundamentals and applications.

Electrochemistry: Electrolytes, types of electrodes and its applications. pH **–** Principle, Measurement, Numerical Examples, Buffers and Buffer index.

Colloidal Chemistry – Properties of colloids, colloidal dispersions, stability of colloids and applications.

Instrumental Method of analysis: Colorimetry - Principles and applications. Applications of Analytical Chemistry – emission and absorption techniques.

Water and Wastewater analysis: Acidity, alkalinity, Hardness, DO, BOD and COD. Trace Contaminants and their analyses.

Microbiology - Microorganisms of importance in air, water and soil environment Principles and applications of microscopy, microscopic flora and fauna of importance. Metabolism and metabolic pathways, Bioconcentration, Biomagnification and Bioaccumulation.

Bacteria – Morphology, typical growth curve and generation time, Measurement Techniques – APC, MPN (Probability and Thomas methods), MFT. Monod's equation and its applications.

Algae - Morphology, classification and their importance.

Fungi - Protozoa - morphology, classification and their importance.

Virology - Types, characteristics and enumeration methodology.

Enzymes - classification, kinetics - Michaelis-Menten equation, factors influencing enzyme reaction.

Laboratory Experiments:

Testing the samples for turbidity, Conductivity, Total Hardness, Iron, Fluorides, Nitrates, Phosphates, Heavy Metals. Plate Count test, MPN Tests and MFT Tests.

REFERENCES:

1. Sawyer C.N. and McCarty, P.L ., (2003), **"Chemistry for Environmental Engineering and Science**", 5^{th} Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Stumn and Morgan(1995), "**Aquatic Chemistry",** 3^{rd} Edition**,** John Willey & Sons Newyork.
3. Pelczar M.J ,Chan ECS, Krieg, NR(1998) **"Textbook of Microbiology"** 5th edition Tata McGraw Hill Publishing Co. Ltd., New Delhi.

4. McKinney R.E.(1962) "**Microbiology for Sanitary Engineers**", Newyork McGraw Hill.
5. Gaudy and Gaudy (1980), "**Microbiology for Environmental Scientists and Engineers**", McGraw Hill.
6. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.
7. Relevant Journals.

e- sources:

1. http://nptel.ac.in/courses/103107084/4
2. http://nptel.ac.in/courses/103108100/41

WATER TREATMENT TECHNOLOGY

Course Name	Water Treatment Technology	**Course Code**	16 CVEN1CWT	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	4-0-0-0	**CIE+SEE**	50+50

Course Objectives: The course is designed to train students in the practical aspects of operating and design of water treatment plants, emphasizing safe practices and procedures.

Course Outcomes: On completion of this course, students are able to

CO1: Select the sources of water for various water uses.

CO2: Explain the principles and operation of water treatment systems.

CO3: Explain the processes and design coagulation, flocculation, adsorption, filtration, and disinfection units.

Introduction – Sources of water, necessity of treatment, Critical Water quality parameters, water quality guidelines and standards for various water uses.

Unit operations – principles and design of aeration systems – two film theory, water in air system, air in water system. **Intake structures** – Different types, design criteria.

Principles of sedimentation – types of settling and settling equations, design criteria and design of settling tanks. **Principle of Coagulation and Flocculation** – types of coagulants, coagulant aids, coagulation theory, optimum dose of coagulant, design criteria and numerical examples.

Filtration – theory, types, hydraulics of filter bed, design criteria and design of filters, filter backwash, operational problems and trouble shooting.

Adsorption Process – Types, factors affecting adsorption, kinetics and equilibrium – different isotherm equations and their applications.

Unit processes - disinfection – different types, disinfectants, factors affecting disinfection, methods of disinfection, chemistry of chlorination.

Water Softening – Ions causing hardness, Langelier index, various methods.

Fluoridation and defluoridation – Principles and design.

Trace organic contaminants in water supplies and their removal.

Bench Scale and Pilot Plant studies in water treatment. Rural Water Supply Systems.

REFERENCES:

1. Fair, G.M., Geyer J.C and Okun, (1969) "**Water and Waste water Engineering**" Vol II, John Wiley Publications.

2. Weber W.J., (1975) "**Physico - Chemical Processes for Water Quality Control**".

3. AWWA, (1971), "**Water Quality and Treatment** "McGraw Hill.

4. CPHEEO Manual, (1991), "**Water Supply and Treatment",** GOI Publications.

5. Peavy, H.S., Rowe and Tchobonoglous,G., (1985), **"Environmental Engineering**", McGraw Hill

6. Raju, B.S.N., (1995), "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt.
Co. Ltd., New Delhi.
7. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.
. World Health Organization, Geneva, (2004), Guidelines for Drinking Water Quality, Third Edition, Volumes 1-3.

WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS

Course Name	Water Resources Engineering And Applied Hydraulics	**Course Code**	16CVEN1CWR	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	3-1-0-0	**CIE+SEE**	50+50

Course Objectives: To make the knowledge base of the student in Hydrology and Hydraulics stronger and broader so that they can handle the design and analysis of the environmental systems with confidence.

Course Outcomes: On completion of this course, students are able to

CO1: Estimate rainfall, optimum rain gauges and consistency with the concept hydrology.

CO2: Solve problems on hydrograph, low and high flow.

CO3: Estimate discharge in rivers, streams and overland peak flows, design of storm drains and outfall sewer.

CO4: Apply the concepts of hydraulics to design water mains, steady state groundwater problems; Outline application of GIS to water resources engineering

Water resources of the world, India and Karnataka, National Water Policy.

Hydrology - Hydrologic cycle, estimation of missing precipitation and rain guage density.

Hydrograph theory - Unit hydrograph – derivation, flow routing, low flow analysis.

Urban Hydrology - Run-off estimation – Design of Stormwater Drains.

Basics and applications of Remote Sensing in water resources management.

Unsteady Flow through Conduits - Water hammer analysis, Water hammer protection methods - surge tanks.

Flow Measurements – Area –Velocity method, Weir method, flumes, end-depth method & chemical and radioactive tracers method

Groundwater - Basic equations of flow, confined and unconfined aquifers, sea water intrusion, artificial recharge, groundwater pollution, borewells - types & design principles, open wells – types, yield tests.

REFERENCES:

1. Raghunath H.M.(1988), "**Advanced Hydrology**", Wiley Eastern Ltd New Delhi

2. Subramanya K.S(1994)., "**Advanced Hydrology".Tata Mc Graw Hill, New Delhi**

3. David Keith Todd(1980), "**Ground Water Hydrology**".2nd Edition John Wiley & Sons New Delhi

4. Sabins F.F(1997)., "**Remote Sensing – Principles and Interpretations**", W.H. Freeman & Co.

5. Anji Reddy, (2001), "**Remote Sensing and GIS**", B.S. Publications, Hyderabad.

6. Ven T. Chow (1988), "**Hand Book of Applied Hydrology",** 1st Edition Mc Graw Hill Publications .

7. Hammer M.J, and Mackichan K.A.(1981), "**Hydrology and Quality of Water Resources**", Newyork:Wiley.

8. John Permankian, **"Water Hammer Analysis**".

9. Linsley, Franzini, Freyberg, Tchobanoglous G.(1992), "**Water Resources Engineering**", TATA McGraw Hill Series.
10. Linsley, Kohler and Paulhes(1975), "**Hydrology for Engineers**", McGraw Hill.
11. Mays L.W. (2004), **"Water Resources Engineering**", John Wiley and Sons Publications.

WASTEWATER TREATMENT ENGINEERING

Course Name	Wastewater Treatment Engineering	**Course Code**	16CVEN1CWW	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	3-0-1-0	**CIE+SEE**	50+50

Course Objective: To provide a basic description and understanding of the principal unit operations and processes used in the treatment of wastewater. This will include coverage of the scientific basis of each unit process, as well as the conventional approach to their engineering design.

Course Outcomes: On completion of this course, students are able to

CO1: Select appropriate treatment units for municipal effluents and explain the concept of a unit operations and unit processes.

CO2: Explain the principles and design the unit operations and processes for wastewater treatment.

CO3: Propose how residuals from wastewater treatment plants and wastewater from rural places can be managed.

CO4: Choose advanced treatment technologies for wastewater treatment.

Objectives of wastewater treatment, characteristics, flow variations, types of reactors and reactors analysis. Wastewater Treatment Flow Diagrams and Hydraulic Profile.

Theoretical principles and design - screens, equalization basin, grit chamber, primary and secondary settling tanks.

Kinetics of biological treatment systems – biokinetic constants and their determination, batch and continuous systems.

Theoretical principles and design – suspended growth system - conventional activated sludge process and its modifications.

Theoretical principles and design – attached growth system – trickling filter, bio-towers and rotating biological contactors. Principles and design of stabilization ponds

Sludge Processing – separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic.

Advanced Wastewater Treatment – Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Wastewater disinfection.

Rural wastewater systems – septic tanks, two-pit latrines, eco-toilet, soak pits.

Laboratory Experiments:

Testing the samples for pH, Alkalinity, total solids, total dissolved solids, DO, BOD and COD.

REFERENCES:

1. Benefield R.D., and Randal C.W., (1980), **"Biological Process Design for Wastewater Treatment"**, Prentice Hall, Englewood Chiffs, New Jersey.

2. Metcalf and Eddy Inc., (2003), **"Wastewater Engineering - Treatment and Reuse",** 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

3. Karia G.L., and Christian R.A., (2001**), "Wastewater Treatment Concepts and Design Approach",** Prentice Hall of India Pvt. Ltd., New Delhi.

4. Ronand L., and Droste, (1997),"**Theory and Practice of Water and Wastewater Treatment**", John Wiley and Sons Inc.

5. Fair G.M., Geyer J.G and Okun, "**Water-wastewater Engineering**".

6. Lee C.C., and Lin S.D., (1999), **"Handbook of Environmental Engineering Calculations",** McGraw Hill, New York.

7. Gaudy,(1972) "**Advanced Wastewater Treatment".**

8. **"Industrial Safety and Pollution Control Handbook", (1991),** National Safety Council and Associate (Data) Publishers Pvt. Ltd.,

9. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.

STATISTICS AND COMPUTATIONAL METHODS

Course Name	statistics and computational methods	**Course Code**	16CVEN1ESC	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	4-0-0-0	**CIE+SEE**	50+50

Course Objective: To enable the students apply Numerical techniques, basic optimization concept and statistics to various areas of environmental engineering like sampling and analysis, modelling etc.

Course Outcomes: On completion of this course, students are able to

CO1: Apply statistical techniques to examine experimental data.

CO2: Solve engineering problems that involve constrained resource allocation.

CO3: Solve the governing equations of partial differential in nature applied to engineering problems.

Statistics - Statistical methods, scope and limitations, population and sample, frequency distribution-measure of central tendency-measures of Dispersion-Mean, Median ,Mode, standard deviation, coefficient of variation, skewness and their applications. Frequency Distribution, Method of Least Squares and Regrssion, Multiple Regression .

Probability – Concepts, Methods, Binomial, Poisson and Normal distribution.

Statistical decisions: Hypothesis testing, significance levels Significance Tests.

Optimization – classification and importance in Environmental Studies, introduction to optimization without and with constraints, **Linear Programming –** different methods.

Numerical Methods - Partial differential equations, Newton-Raphson method.

Finite difference, method of characteristics, different methods, Successive over relaxation methods.

REFERENCES:

1. Rao. S.S.(1979) **Optimization: Theory & Applications Techniques**, Wiley Eastern Ltd New Delhi.
2. Taha H.A.,(2007), "**Optimization Research":An introduction**, Pear son Prentice Hall, 8th Edition
3. Shanthakumar M.S., **Numerical Methods and Analysis,** Tata McGrawhill Pubs.
4. Ross S.M.,(1987) "**Introduction to Probability and Statistics for Engineers and Scientists"**, John Wiley Publications.3rd Edition, Acedimic press
5. Stanton(1961) R.G –" **Numerical methods for science and engineers"**.Prentice Hall, Trade Edition
6. Kreyszig Erwin(2006),9th Edition" **Advanced Engineering Mathematics"**, Wiley Eastern Publications.
7. Berthouex P M.,and Brown L. C.(1994), "**Statistics for Environmental Engineers"**, Lishers publication, 2nd Edition

BMS COLLEGE OF ENGINEERING, BANGALORE – 560 019
(Autonomous College under VTU)
DEPARTMENT OF CIVIL ENGINEERING
M. TECH – ENVIRONMENTAL ENGINEERING - SCHEME 2016-2017

ENVIRONMENTAL LEGAL ASPECTS AND POLICY GUIDELINES

Course Name	Environmental Legal Aspects And Policy Guidelines	**Course Code**	16CVEN1ELP	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	4-0-0-0	**CIE+SEE**	50+50

Course Objective: The course provides an overview of some of the major environmental statutes in India. The course addresses the variety of regulatory tools and concepts that can be used to prevent environmental harm, focusing on the proper match between regulatory tool and environmental harm.

Course outcomes: On completion of this course, students are able to

CO1: Assess the lawfulness of administrative agency and private action towards the environment by application of the relevant environmental statute or agency regulation.

CO2: Explain the role of the Central and state judiciaries, as well as state legislatures and agencies, in formulating and implementing environmental policy.

Environment Definitions and Acts: Environment definition in Indian law- Different environmental protection legislations- History of Environmental protection in India - Provisions in Indian Penal Code for Environmental protection-The constitutions of India – Union list- State list – Concurrent list - Panchayats and Municipalities role

Water (prevention & control of Pollution) Act & Air (prevention & control of Pollution) Act : Water pollution – definition – Water (Conservation and protection) Act 1974 – Objectives of Water Act – Legislation to control water pollution – Functions of CPCB and SPCB - Local bodies role – Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 - Water (prevention & control of

Pollution) Cess Act 1977 as amended by Amendment Act 1987 and relevant notifications - Tolerance limits for effluents discharge and drinking water - Constitution and Resources management and pollution control – Air (prevention & control of Pollution) Act 1981-Sections of Air (prevention & control of Pollution) Act 19, 20, 21, 22-Penalties -Ambient air quality standards-Noise and the Laws.

Environmental (Protection) Act 1986 : Environment and pollution - definition as per Environmental law-General powers of Central and state Government under EPA-Important Notification in EPA 1986- The Indian Forest Act 1927- Forest Conservation Act 1980 - Wild Life (Protection) Act - Constitution of Pollution Control Boards - Powers, functions, Accounts, Audit etc. – Equitable remedies for pollution control

Municipal Solid Waste Management Rules Solid waste management – Hazardous Wastes (Handling and Management) Rules 1998-Bio-medical Wastes (Handling and Management) Rules 1998-Recyclled plastics (Manufacture and Usage) Rules, 1999-Municipal Solid Waste Management Act 2003- Rules - E.I.A and Public Hearing- Eco-labeling-Eco Mark.

Coastal Regulation Zone Notification and Green Benches Coastal Regulation Zone - definition-Importance of coral reef-Regulation activities in CRZ - The Biological Diversity Act 2002-Bio diversity Rules 2004-The Intellectual Property Rights (IPR)-National Environment Appellate Authority –Environmental Tribunal and Green Benches - Some Important cases on Environment - International Conventions - Protocols for protection of the Environment

REFERENCES:

1. Constitutional Law of India – J.N. Pandey 1997 (31st Edn.) Central Law Agency Allahabad.
2. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.

3. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997.

4. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.

5. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notification.

6. Environmental Laws of India-C.P.R. Environmental Education Centre.

RENEWABLE ENERGY AND ALTERNATIVE FUELS

Course Name	Renewable Energy And Alternative Fuels	**Course Code**	16CVEN1ERF	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	4-0-0-0	**CIE+SEE**	50+50

Course Objective:

This course creates awareness in students about importance of alternative fuels, combustion and emission characteristics of various gaseous and liquid alternative flues.

Course outcomes: On completion of this course, students are able to

CO1: Outline the need and application of various alternative fuels.

CO2: Explain various methods/technologies to harness various renewable energy sources.

CO3: Outline limitation of fossil fuels and combustion characteristics fuels

Introduction to energy and resources – Renewable energy sources - Availability of solar energy – Sun-earth relationships - - Solar radiation measurement – Flat plate collectors – Solar water heating systems – Evacuated Tubular Concentrators - Solar air heating systems and applications – Concepts on solar drying, cooking, desalination, solar ponds and solar cooling - Passive heating and cooling of buildings – Basics of solar concentrators and types Solar thermal power generation

Biomass to energy conversion processes – Anaerobic digestion, process parameters, biogas composition, digester types, high rate anaerobic conversion systems – Alcohol from biomass – Biodiesel: preparation, characteristics and application - Biomass combustion and power generation – Briquetting – Gasification: Process, types of gasifiers, applications – Waste to energy technologies.

Power in the wind - Types of wind mills – WEG components, Power curves and energy estimation– Indian wind potential. Small Hydro Power: Types, site identification, head and flow measurement, discharge curve, estimation of power potential and system components. Technologies for harnessing renewable energy sources like geothermal, wave, tidal and ocean thermal energy.

Fossil fuels and their availability - Potential alternative liquid and gaseous fuels - Merits and demerits of various alternative fuels – Engine requirements Methods of production - Properties - Blends of gasoline and alcohol - Performance in SI engines – Adaptability - Combustion and emission characteristics - Performance in CI engines - Emission characteristics - Properties of alcohol esters. Production and properties of CNG, LPG, hydrogen gas, biogas and producer gas - Performance and Storage, distribution and safety aspects

Various vegetables oils - Properties - Esterification - Performance and emission characteristics - Bio-diesel: Feed stock, characteristics, preparation (lab and commercial), storage, applications, environmental impacts, economics, and policy.

REFERENCES:

1. Frank Kreith and D.Yogi Goswami (2007), Handbook of Energy Efficiency and Renewable Energy, CRC Press.
2. John Twidell and Tony Weir (2006), Renewable Energy Resources, 2nd Edition, Taylor & Francis, USA.

3. John A. Duffie and William A. Beckman (2006),

4. Solar Engineering of Thermal Process, 3rd Edition, John Wiley & Sons.

5. Gilbert M. Masters (2004), Renewable and Efficient Electric Power Systems, Wiley Interscience.

6. Osamu Hirao and Richard Pefley (1988), Present and Future Automotive Fuels, Wiley Interscience Publication, New York

7. Alcohols and Motor Fuels: Progress in Technology - Series No. 19 - SAE Publication USA C

REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING

Course Name	Remote Sensing And GIS In Environmental Engineering	**Course Code**	16CVEN1ERG	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	3-0-0-1	**CIE+SEE**	50+50

Course Objective: To enable understanding of basics in remote sensing ,gis and applications in environmental engineering

Course outcomes: On completion of this course, students are able to

CO1: Explain the basic principles of Remote sensing and GIS.

CO2: Outline the importance and concept of image processing

CO3: Apply knowledge of RS-GIS for various environmental problems

Fundamentals Of Remote Sensing

Definition, Physics of Remote Sensing, Electromagnetic Radiation and its interactions with atmosphere, Spectral reflectance of earth features, Resolution spectral, spatial, Temporal and Radiometric.

Platforms and Sensors

Aerial Photographs, Active and passive sensors, Data products, Various satellites in orbit and their sensors. Image Processing- Visual and digital image, Interpretation ,Interpretation keys, Methodology , Training sets, Ground truth verification, Image analysis, Image enhancement, Rectification, Classification methods, Users accuracy, producers accuracy and overall accuracy.

Introduction To GIS

Data entry, storage and maintenances, Data output. Data analysis, Hardware and software.

Applications of Remote Sensing And GIS

Application of remotely sensed data for identifying solid waste disposal, forest fire mapping, EIA studies etc., Optimal routing of solid waste using GIS – Case Study, Environmental siting of industries and zoning atlas development, Remodeling of water distribution system using GIS, Environmental degradation assessment using RS and GIS.

REFERENCES:

1. Lillies and T.M. and Kiefer, R.W., " **Remote Sensing and Image Interpretation",** John Wiley and Sons, 1994.
2. Burrough, P.A. and McDonnell, R.A., **"Principles of Geographical Information Systems"**, Oxford University press, 1998
3. Lintz,J. and simonet, **" Remote sensing of Environment"**, Addison Wesley Publishing Company, 1994
4. Mishra H.C., (1997), "**GIS Handbook**", GIS India, Shanthi Nivas, Hyderabad.
5. Syed R. Qasim, Edward M. Motley & Guang Zhu, **"Water Works Engineering: Planning, Design and Operation",** Eastern Economy Edition, PHI Learning Private Limited, New Delhi.

SOLID WASTE ENGINEERING AND MANAGEMENT

Course Name	Solid Waste Engineering And Management	**Course Code**	16CVEN1ESW	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	3-0-0-1	**CIE+SEE**	50+50

Course Objective: To familiarize the students on segregation, collection, transportation, recycling and disposal of municipal solid waste in such a way that its impact is minimal on environment, economy and community.

Course Outcomes:

CO1: Outline sources, types and composition of solid waste with methods of handling, sampling and storage of solid waste.

CO2: Select the appropriate method for solid waste collection, transportation, segregation and its treatment.

CO3: Describe methods of disposal of Municipal solid waste and Biomedical waste.

CO4: Outline the recent developments in resource recovery and role of GO's and NGO's in waste management.

Land pollution and control – Land Pollution sources and their impacts , general control measures.

Solid waste – sources and engineering classification, characterization, generation and quantification.

Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Treatment methods - various methods of refuse processing, recovery, recycle and reuse, composting – aerobic and anaerobic, incineration, pyrolysis and energy recovery,

Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Recent Developments in Solid Wastes Reuse and Disposal – Power Generation, Blending with construction materials and Best Management Practices (BMP).

Role of various organizations in Solid Waste Management – Governmental, Non-Governmental, Citizen Forums.

Biomedical Waste Management – sources, treatment and disposal

REFERENCES:

1. Tchobanoglous G., Theissen H., and EIiassen R.(1991), **"Solid Waste Engineering - Principles and Management Issues**", McGraw Hill, New York.

2. Pavoni J.L(1973)., "**Handbook of Solid Waste Disposal**".

3. Peavy, Rowe and Tchobanoglous (1985), "**Environmental Engineering**", McGraw Hill Co. 4th Edition

4. Mantell C.L., (1975), "**Solid Waste Management**", John Wiley.

5. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.

6. Vesiland A.(2002), "**Solid Waste Engineering**", Thompson Books.

7. Biomedical (Handling and Management) Rules 2008

e- sources:

http://nptel.ac.in/courses/120108005/

GLOBAL WARMING AND CLIMATE CHANGE

Course Name	Global Warming And Climate Change	**Course Code**	16CVEN1EGC	**SEE Duration**	03 Hrs
Credits	04	**L-T-P-S**	3-0-0-1	**CIE+SEE**	50+50

Course Objective: To enable the students to learn important issues and aspects of Climate change, and control methods like cleaner technologies and carbon sequestration.

Course Outcomes: On completion of this course, students are able to

CO1: Identify the various issues pertaining to climate change.

CO2: Outline the various impacts of climate change globally and on regional scale.

CO3: Write on cleaner technologies and carbon sequestration.

Energy Issues and Climate Change , Alternate Energy Sources

Green-House Effect as a Natural Phenomenon, Green House Gases (GHGs) and their Emission Sources

Quantification of CO_2 Emission, Global Warming Potential (GWP) of GHGs

Modeling Climate change, Ozone layer depletion and its control

Impacts of climate change – Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Coastal Flooding, Wetlands and Estuaries loss

Kyoto Protocol – Importance, Significance and its role in Climate Change

Carbon Trading - Mechanisms , Various Models (European, Indian) Global and Indian Scenario

Cleaner Development Mechanisms – Various Projects related to CO_2 Emission Reduction

Alternatives of Carbon Sequestration – Conventional and non-conventional techniques, Role of Countries and Citizens in Containing Global Warming

REFERENCES:

1. Barry R.G., and Chorley R.L., (1992), **"Atmosphere, Weather and Climate",** 4th Edition, ELBS Publication.

2. Bolin B., (Ed.), (1981), **"Carbon Cycle Modelling",** John Wiley and Sons Publications.

3. Corell R.W., and Anderson P.A., (Eds.), (1991), **"Global Environmental Change",** Springler Verlog Publishers.

4. Francis D., (2000), **"Global Warming: The Science and Climate Change",** Oxford University Press.

5. Frame B., Medury Y., and Joshi Y., (Eds.), (1992), **"Global Climate Change: Science, Impact and Responses".**

6. Linden E., (2006), **"The Winds of Change: Climate, Weather and the Destruction of Civilizations",** Simon and Schuster Publications.

7. Mintzer I.M., (Ed.), (1982), **"Confronting Climate Change, Risks, Implications and Responses"**, Cambridge University Press.
8. Srivatsava A.K., (2007), **"Global Warming",** APH Publications.
9. Wyman R.L., (Ed.), (1991), **"Global Climate Change and Life on Earth",** Chapman and Hall Publications.
10. Yadav, Chander and Bhan, (2005), **"Global Warming: India's Response and Strategy",** RPH Publications.

RESEARCH METHODOLOGY

Course Name	Research Methodology	**Course Code**	16EPIM1CRM	**SEE Duration**	03 Hrs
Credits	02	**L-T-P-S**	2-0-0-0	**CIE+SEE**	50+50

Module 1:

Meaning, Objectives and Characteristics of research - Research methods Vs Methodology -Types of research - Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs Qualitative, Conceptual Vs. Empirical - Research process - Criteria of good research - Developing a research plan.

Module 2:

Defining the research problem - Selecting the problem - Necessity of defining the problem -Techniques involved in defining the problem **-** Importance of literature review in defining a problem **- S**urvey of literature - Primary and secondary sources - Reviews, treatise, monographspatents - web as a source - searching the web - Identifying gap areas from literature review -Development of working hypothesis.

Module 3:

IPRs- Invention and Creativity- Intellectual Property-Importance and Protection of Intellectual Property Rights (IPRs)- A brief summary of: Patents, Copyrights, Trademarks, Industrial Designs- Integrated Circuits-Geographical Indications-Establishment of WIPO-Application and Procedures.

Module 4:

Aim of this part of the course: is to strengthen students minds towards high quality research through publications, patents and also to learn research ethics.

Publications

Research concepts, Research importance on economy, Research in India and abroad, Importance of publications, Why, where, when to publish?

Publication ethics , Plagiarism (how to use turn it in effectively), International ethics on research, What and what not to publish, Ethical guidelines, Case studies

Quality vs quantity Searching literature with high quality, Impact factor, Citations (google scholar vs web of science), H-index, Case studies

How to write paper, In High quality journals, Conference Articles, Poster preparation, PhD thesis, Inclusion of References

Journal reviewing process, Selection of the good journal, Knowledge bout journal template, Refereeing process, Research topic selection, Research today and tomorrow, Lab scale to Industry, Traditional research to Technology based research

Module 5: Self study

Interpretation and report writing - Techniques of interpretation - Structure and components of scientific reports - Different steps in the preparation - Layout, structure and language of the report - Illustrations and tables - Types of report - Technical reports and thesis

REFERENCES:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.

3. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi

4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.

5. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

6. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.

7. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications

8. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.

9. Intellectual Property Rights in the Global Economy: Keith Eugene Maskus, Institute for International Economics, Washington, DC, 2000

10. Subbarau NR-Handbook on Intellectual Property Law and Practice-S Viswanathan Printers and Publishing Private Limited.1998