SYLLABUS

(WITH EFFECT FROM 2018 -19)

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(±ÉÊPÀëtÂPÀªÀµÀð 2018-19)

VII to VIII Semester

Bachelor Degree

In

Civil Engineering

OUT COME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

P.E.S. College of Engineering

Mandya - 571 401, Karnataka
(An Autonomous Institution Affiliated to VTU, Belagavi)
Grant -in- Aid Institution
(Government of Karnataka)
Accredited by NBA, New Delhi
Approved by AICTE, New Delhi.

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Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running eight undergraduate and Eight Postgraduate programs. It consists of Six M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has recently become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills and Personality Development modules have been added to the existing curriculum of the academic year 2015-16. Industry Interactions have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are included in all undergraduate programs.

Dr. Umesh D R
Deputy Dean (Academic)
Associate Professor,
Dept. of Computer Science &Engg.

Dr.R.Girisha
Dean (Academic)
Professor,
Dept. of Computer Science&Engg.

PES College of Engineering

VISION

"PESCE shall be a leading institution imparting quality engineering and management education, developing creative and socially responsible professionals"

MISSION

- Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching -learning practices
- Impart engineering and managerial skills through competent and committed faculty using Outcome Based Educational curriculum
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs
- Promote research, product development and industry-institution interaction.

DEPARTMENT OF CIVIL ENGINEERING

The Civil Engineering Department was started in the year 1962 as one of the first branches in P.E.S. College of Engineering, Mandya with an intake of 40. The department has carved a niche for itself by offering the most competent instructional programs to the students. The department is running an undergraduate programme with an intake of 120 and it has started PG in CAD Structures with an intake of 18 in the year 2006. The department has been recognized as research centre under VTU, Belgaum. The department is accredited by NBA, New Delhi for five years (2004-2009). The department is well equipped with laboratories, computing facilities, independent library and other infrastructure. The department has well qualified and experienced teaching faculties. The department also takes up consultancy work pertaining to planning, structural designs of buildings, testing of materials, soil investigation.

Vision

To attain Excellence in imparting quality civil engineering education to meet the societal needs.

Mission

- Impart civil engineering and managerial skills with state of art infrastructure, competent and committed faculty using outcome based educational curriculum.
- Promote research, project management and consultancy
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.

The Program Educational Objectives (PEOs)

- Apply technical competence in the field of Civil Engineering with a strong background in basic science and mathematics.

- Analyse and interpret data to design or evaluate civil engineering systems to satisfy societal needs with the use of modern tools including higher education.
- Function effectively as an individual and or to work in a team on multispecialized civil engineering projects with professional ethics and effective communication skills inculcating the habit of life-long learning.

Program Specific Outcomes (PSOs)

The Program specific outcomes have been derived from the PSC's defined by ASCE. By the time of graduation, Civil Engineering students will be able to

PSO1: Apply knowledge of basic science to analyze and solve problems in the core area of Civil Engineering such as Structural, Geotechnical, Transportation, Environmental, Hydraulics and Water resources engineering.

PSO2: Analyse, Plan, design, quality assessment and cost estimate of Civil Engineering structures with professional ethics.

PSO3: Work in a consulting organization or can be an entrepreneur to investigate and supervise Civil Engineering structures using modern tools and technology to provide sustainable solutions to meet the societal needs.

Programme Outcomes (PO)

Engineering program must demonstrate that their students attain the following outcomes:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.
4. **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.
5. **Modern Tool Usage**: Create, select, 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. **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 practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

VII – Semester

Sl. no	Course Code	Course Title	Teaching Department	Hrs/Week			Credits	Examination Marks		
				L	T	P				
1	P18CV71	Quantity surveying and Contract Management	Civil	4	-	-	04	50	50	100
2	P18CV72	Design of Steel Structures	Civil	4	-	-	04	50	50	100
3	P18CV73	Applied Geotechnical Engineering	Civil	4	-	-	04	50	50	100
4	P18CV74X	Professional elective	Civil	2	2	-	03	50	50	100
5	P18CV75X	Open Elective –II	Civil	3	-	-	03	50	50	100
6	P18CVL76	Environmental Engineering laboratory	Civil	-	-	3	1.5	50	50	100
7	P18CVL77	CAD Laboratory - II	Civil	-	-	3	1.5	50	50	100
8	P18CV78	Project Work Phase – I and Project seminar	Civil	-	-	4	2	100	-	100
Total							**23**	**450**	**350**	**800**

List of Electives

Professional Elective - III			Open Elective – II		
Sl.no	**Course Code**	**Course Title**	**Sl. no**	**Course Code**	**Course Title**
1	P18CV741	Design of Bridges	1	P18CVO751	Environmental Impact Assessment
2	P18CV742	Prefabricated structures	2	P18CVO752	Atmospheric Environmental Pollution and Control
3	P18CV743	Open Channel Hydraulics	3	P18CVO753	Building services
4	P18CV744	Advanced Foundation Design	4	P18CVO754	Remote Sensing and introduction to Geoinformatics

VIII – Semester

Sl. no	Course Code	Course Title	Teaching Department	Hrs/Week			Credits	Examination Marks		
				L	T	P				
1	P18CV81	Pre stressed concrete structures	Civil	4	-	-	04	50	50	100
2	P18CV82X	Professional Elective - IV	Civil	2	2	-	03	50	50	100
3	P18CV83	Internship	Civil	-	-	-	02	50	50	100
4	P18CV84	Project Work Phase – II	Civil	-	-	-	06	100	100	200
5	P18CV85	Self-study course & Seminar	Civil	-	-	04	02	50	-	50
Total							**17**	**300**	**250**	**550**

Professional Elective - IV

Sl.no	Course Code	Course Title
1	P18CV821	Earthquake resistant design of structures
2	P18CV822	Ground Improvement Technique
3	P18CV823	Environmental Impact Assessment
4	P18CV824	Pavement Analysis and Design

Course Title: QUANTITY SURVEYING AND CONTRACT MANAGEMENT			
Course Code: P18CV71	**Semester: VII**	**L - T – P : H : 4-0–0:4**	**Credits :04**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Building planning and drawing, Design and drawing of RCC structures, Basic surveying.			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Understand the various drawings and to learn the calculation of quantities of materials
2. Learn the definition and objective of specifications
3. Learn the rate analysis
4. Compute the earthwork for roads
5. Learn various concepts of contracts

Course Content

UNIT - I

ESTIMATION: Study of various drawings with estimates, important terms, units of measurement, abstract of estimates. Methods of taking out quantities and cost – center line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings with flat roof.

18 Hrs

Self-Study Component: Sloped RCC roofs with all Building components, Use of spread-sheets for preparation of estimates.

UNIT-II

ESTIMATES: Steel truss (Fink and Howe truss), manhole and septic tanks,

MEASUREMENT OF EARTHWORK FOR ROADS: Methods for computation of earthwork – cross sections – mid section formula or average end area or mean sectional area, trapezoidal &prismoidal formula.

12 Hrs

Self-Study Component:Estimate of RCC slab and pipe culverts. Estimate of metalled road and premix carpeting.

UNIT-III

SPECIFICATIONS: Definition of specifications, objective of writing specifications, essentials in specifications, general and detail specifications of common item of works in buildings.
(Earth work in foundation, Cement concrete in foundation RCC works Class I and II brick works, Reinforced brickworks, plastering , pointing, C.C. flooring, color washing painting on ironwork, wood work painting, stone masonry G.I. Sheet roofing, Mangalore tile roofing).
RATE ANALYSIS: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items.

12Hrs

Self-Study Component: Wood and steel works for doors, windows and ventilators.

UNIT-IV

CONTRACTS: Types of contract – essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms – Tender, earnest money deposit, security deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders. Duties and liabilities, termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements

Valuation: Gross income, net income, outgoings, scrap & salvage values, depreciation and method of valuation.

10 Hrs

Self-Study Component: – Preparation of bills.

TEXT BOOKS:

1. **Estimating and costing** – B. N. Dutta, UBS publishers Distributors Ltd, India.
2. **Quantity Surveying**- P.L. Basin S. Chand and company, New Delhi.
3. **Estimating & Specification** - S.C. Rangwala,Charotar publishing house, Anand.

REFERENCE BOOKS:

1. **Text book of Estimating & Costing**- G.S. Birde, DhanpathRai and sons: New Delhi.
2. **A text book on Estimating, Costing and Accounts**- D.D. Kohli and R.C. Kohli S. Chand: New Delhi.
3. **Estimation and costing** – H S Vishwanath, Sapna publications.
4. **P**.W.D Schedule of Rates and N.B.C

Note: Self-study for 5 marks only in CIE and not in SEE

Course Outcomes (CO's)

After learning all the units of the course, the student is able to,

1. Apply the knowledge of engineering fundamentals for quantifying and cost estimate of buildings, roads, steel truss, man holes and septic tanks.
2. Evaluate the rate analysis for different items of buildings as per applicable specifications.
3. Demonstrate the calculation of Earth quantity for roads and canals.
4. Understand how to prepare a notice inviting tender document for bidding.

C. Evaluation Scheme

- **UNIT-I is compulsory for 40 marks**
- **Student should answer One question each from UNIT-II, UNIT-III and UNIT-IV of 20 marks.**

Course Articulation Matrix

Sl. no	Course Outcomes (CO)	Program Outcomes												Program Specific Outcomes		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P1 O	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	Apply the knowledge of engineering fundamentals for quantifying and cost estimate of buildings, roads, steel truss, man holes and septic tanks	2	2											2		
2	Carry out rate analysis for different items of buildings as per applicable specifications	1	2												2	
3	Demonstrate the calculation of Earth quantity for roads and canals.		2												2	
4	Understand how to prepare a notice inviting tender document for bidding	1								2						2

Course Title: DESIGN OF STEEL STRUCTURES			
Course Code: P18CV72	**Semester: VII**	**L - T – P : H : 4-0–0:4**	**Credits : 04**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weight age: CIE:50; SEE:50**	
Prerequisites:Strength of Materials, Structural analysis.			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Learn the analysis and design of steel structures.
2. Understand the Codal provisions.
3. Learn different types of connections.
4. Learn the analysis and design of various components of steel structures.
5. Understand the plastic behaviour of steel structures.

Course Content

UNIT – I

STEEL STRUCTURES AND CODAL SPECIFICATION: Advantages and Disadvantages of steel structures, Principles of Limit state method(LSM) of design, failure criteria for steel, codes, specifications and section classification.

ANALYSIS AND DESIGN OF BOLTED CONNECTION

Introduction to bolted connections, Behavior of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High strength friction Grip bolts (HSFG), pin connections, simple Bolted connections of tension members. Efficiency of joints.Beam to Beam connections and Beam to Column framed connections.

10Hrs

Self-Study Component: Loads and Load combinations, Design considerations.

UNIT – II

ANALYSIS AND DESIGN OF BOLTED CONNECTION: Moment resistant bracket connections, moment acting in the plane of joint, moment acting in the plane perpendicular to the joint.

WELDED CONNECTIONS:

Introduction, Advantages and disadvantages of welded connections, types of welds, strength of welds, Design of welded connections for tension members and bracket connections.

10Hrs

Self-Study Component: Defects in weld

UNIT – III

DESIGN OF TENSION MEMBERS:

Introduction, types of tension members, Slenderness ratio, Behaviour of tension members, Modes of failure, Design strength of tension members, Design of splices, Design of tension members, Lug angles.

DESIGN OF COMPRESSION MEMBERS: Introduction, Failure modes, Strength of compression

members, Sections used for compression members, Slenderness ratio, Effective length of compression members, Design of single section compression members.

10Hrs

Self-Study Component: Prying forces

UNIT – IV

DESIGN OF COMPRESSION MEMBERS: Design of compression members- built up compression members. Design of lacing and battening system.

DESIGN OF COLUMN SPLICE AND BASES:

Design of column splices (for columns of same and different sections). Design of simple slab base and gusseted base.

12Hrs

Self-Study Component: Grillage foundation

UNIT – V

INTRODUCTION TO PLASTIC BEHAVIOUR OF STRUCTURAL STEEL:

Introduction, Plastic theory, Plastic hinge concept and shape factors, Plastic collapse load, conditions of Plastic analysis, Theorem of Plastic analysis, Plastic analysis of continuous beams.

DESIGN OF BEAMS: Introduction, Beam types, lateral stability of beams, factors affecting lateral stability. Analysis and design of laterally supported and laterally unsupported beams, Check for deflection.

10Hrs

Self-Study Component: Plastic Analysis of portal frames

TEXT BOOK:

1. **Design of Steel Structures**- N. Subramanian, Oxford.
2. **Design of steel structure –**Prof. V.L.Shah and Prof. Veena Gore, structure publication, standard publishers and distributors.

REFERENCE BOOKS:

1. **Design of steel Structures**-Ramachandra, vol I, standard book House.
2. **Comprehensive Design of steel Structures**, Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
3. **Design of Steel Structures**, Duggal.
4. **Bureau of Indian standards** IS 800-2007, IS 875-1987.
5. Steel Tables.

Note: Self-study for 5 marks only in CIE and not in SEE

Course Outcomes (CO's)

After learning all the units of the course, the student is able to,

1. Apply the knowledge on steel as a structural material to understand its area of application and the design principle involved as per IS code.
2. Apply limit state design method for the connection of steel members by bolting and welding.
3. Apply limit state design method for the design of tension and compression members and understand the behavior of steel members under axial tension and compression.

4. Ability to apply the concepts of plastic behavior of steel members for the plastic analysis of structural system and to apply the limit state design method for the design of beams.

Course Articulation Matrix																
Sl.no	**Course Outcomes (CO)**	Program Outcomes											**Program Specific Outcomes**			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge on steel as a structural material to understand its area of application and the design principle involved as per IS code.	2		2			1						1	2	1	2
2	Apply limit state design method for the connection of steel members by bolting and welding.	1		2			1						1	1	1	2
3	Apply limit state design method for the design of tension and compression members and understand the behaviour of steel members under axial tension and compression.	1		2			1						1	1	1	2
4	Ability to apply the concepts of plastic behavior of steel members for the plastic analysis of structural system and to apply the limit state design method for the design of beams.	1		2			1						1	1	1	2

Course Title: APPLIED GEOTECHNICAL ENGINEERING			
Course Code: P18CV73	**Semester: VII**	**L - T – P : H : 4-0–0:4**	**Credits :04**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weight age: CIE:50; SEE:50**	
Prerequisites : Geo-Technical Engineering -I			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Gain the knowledge of Science and Geology to compute engineering properties of soil.
2. Sketch the flow nets for soil structures as per Laplace Equation.
3. Learn and analyze earth pressure and stability of slopes for design of earth retaining structures.
4. Evaluate and interpret bearing capacity and settlement data for design of footings.

Course Content

UNIT – I

SUB-SURFACE EXPLORATION: Importance of exploration program, Methods of exploration: Boring, sounding tests, geophysical methods- Electrical resistivity and Seismic refraction methods. Types of samples, undisturbed, disturbed and representative samples Samplers, sample disturbance, area ratio, Recovery ratio, clearance ratios, Stabilization of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures.

DRAINAGE AND DEWATERING: Location of ground water table in fine and coarse grained soils. Determination of ground water level by Hvorselev's method. Dewatering- Ditches and sumps, well point system, Shallow well system, Deep well system, Vacuum Method, Electro- Osmosis method.

Self-Study Component: Soil exploration report. Control of ground water during excavation.

12 Hrs

UNIT – II

STRESSES IN SOILS: Boussinesq's and Westergaard's theories for concentrated, circular, rectangular, line and strip loads. Comparison of Boussinesq's and Westergaard's analysis. Nemark's chart.

FLOWNETS: Laplace equation (no derivation) assumptions and limitations only, characteristics and uses of flow nets, Methods of drawing flow nets for Dams and sheet piles. Estimating quantity of seepage and exit gradient. Determination of phreatic line in earth dams with and without filter. Piping and protective filter graded filter.

Self-Study Component: contact pressure.**10 Hrs**

UNIT – III

LATERAL EARTH PRESSURE: Active and passive earth pressures, Earth pressure at rest, Earth pressure coefficient. Earth pressure theories- Rankine's and Coulomb's –assumptions and limitations, Graphical solutions for active earth pressure (cohesion less soil only) –Culmann's and Rebhann's methods, lateral earth pressure in cohesive and cohesion less soils.

Self-Study Component: Earth pressure distribution.**10 Hrs**

UNIT – IV

STABILITY OF EARTH SLOPES: Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of finite and infinite slopes- Method of slices, Friction Circle method, Fellineous method, Taylor's stability number.

10 Hrs

Self-Study Component: Infinite slopes

UNIT – V

BEARING CAPACITY: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's and Brinch Hansen's bearing capacity equations-assumptions and limitations Bearing capacity of footing subjected to eccentric loading. Effect of ground water table on bearing capacity. Plate load test, Standard penetration test, cone penetration test.

FOUNDATION SETTLEMENT: Settlement Analysis, Data for settlement analysis, computation of settlement, Concept, immediate, consolidation and secondary settlements (no derivations), Tolerance.

10 Hrs

Self-StudyComponent:BISspecificationsfortotalanddifferentialsettlementsoffootingsandrafts.

TEXT BOOKS:

1. Soil Mechanics and Foundation Engg.-Punmia B.C. (2005), 16thEdition Laxmi Publications Co., NewDelhi.
2. Soil Mechanics and Foundation Engineering- Murthy V.N.S.(1996), 4th Edition, UBS Publishers and Distributors, NewDelhi.
3. Soil Engineering in Theory and Practice- Alam Singh and Chowdhary G.R. (1994), CBS Publishers and Distributors Ltd., New Delhi.

REFERENCES:

1 Foundation Analysis and Design- Bowles J.E. (1996), 5th edition, McGraw Hill Pub. Co. New York.
2 Basic and Applied Soil Mechanics- GopalRanjan and Rao A.S.R.(2000), New Age International (P) Ltd., New Delhi.
3 Geotechnical Engineering- Venkatrahmaiah C. (2006), 3rd Edition New Age International (P) Ltd., New Delhi

Note: Self-study for 5 marks only in CIE and not in SEE

Course outcomes

After learning all the units of the course, the student is able to,

1. Apply the knowledge of Science and Geology to estimate Engineering properties of

soil.

2. Prepare the flow nets for soil structures
3. Analyze earth pressure and stability of slopes for design of earth Retaining structures.
4. Evaluate and interpret bearing capacity and settlement data for design of footings.

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of Science and Geology to estimate Engineering properties of soil	2												2		
02	Prepare the flow nets for soil structures			2											2	
03	Analyze earth pressure and stability of slopes for design of earth Retainingstructures.		2	2											2	
04	Evaluate and interpret bearing capacity and settlement data for design of footings.				2										2	

Course Title: Design of Bridges			
Course Code: P18CV741	**Semester: VII**	**L-T-P-H -2-2-0-4**	**Credits:03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Design of RCC Structures,Analysis of Indeterminate Structures.			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Provide basic knowledge of mathematics, science and engineering in the design of bridges, using limit state design
2. Enable Student to identify, formulate and solve Engineering Problems on design of bridges.
3. Give procedural knowledge of Definition, components of bridge, Historical Developments, Site Selection for Bridges, Classification of Bridges, Survey and data collection for a bridge site selection, Hydraulic design, Design Discharge, linear water way, economical span, types of bridges, hydraulic design
4. Give procedural knowledge to design a system, component or process as per needs and specifications of different variety of bridges like slab culvert & T beam bridges subjected to various load combinations with different boundary conditions.
5. Provide factual knowledge on analysis and design of various types of bridges, R.C.C slab Culvert, Box Culvert, T beam Bridge

Course Content

UNIT – I

INTRODUCTION: Definition, components of bridge, Historical Developments, Site Selection for Bridges, Classification of Bridges, Survey and data collection for a bridge site selection, Hydraulic design, Design Discharge, linear waterway, economical span.

12Hrs

Self-study component: The Student shall visit the nearby bridge site and understand the component parts of bridges

UNIT-II

SPECIFICATIONS OF ROAD BRIDGES: Indian road Congress Bridge code, carriageway, clearance, Forces on bridge, Review of IRC loadings, applications of loads on bridge such as dead load, live load, impact effect etc.

1**0Hrs**

Self-study component: Highway bridge loading standards of different countries.

UNIT – III

RCC SLAB CULVERT: Introduction, IRC loadings – Class AA, Class 70R, Class A and Class B, Bending Moment due to dead load and Live load.Structural Design and detailing of Slab Culvert.

10Hrs

Self-study Component: Design of skew slab culvert**.**

UNIT - IV

BOX CULVERT: Loading Cases, IRC Class AA Tracked Vehicle, IRC Class AA Wheeled Vehicle, IRC Class A Loading, Moment Distribution, Structural Design and detailing of Box Culvert.

10Hrs

Self-study component: Structural design of pipe culvert.

UNIT – V

T BEAM BRIDGE: Proportioning of Components, Analysis of Slab Using IRC Class AA Tracked Vehicle, Structural Design of Slab, Analysis of Cross Girder for Dead Load & IRC Class AA Tracked Vehicle, Structural Design of Cross Girder, Analysis of Main Girder Using COURBON'S Method, Calculation of Dead load BM and SF, Calculation of Live load B M & S F using IRC Class AA Tracked vehicle. Structural design and detailing of main Girder.

10Hrs

Self-study component: Distribution of live load on longitudinal Girders by Guyonmassonet method and Hendry jaegar method.

TEXT BOOK:

1. **Johnson D Victor**, Essentials of Bridge Engineering Oxford & IBH Publishing Co New Delhi
2. **Krishna Raju N**, Design of Bridges Oxford & IBH Publishing Co New Delhi

REFERENCE BOOK:

1. **Principles and Practice of Bridge Engineering** by S P Bindra, DhanpatRai& Sons New Delhi.
2. **Relevant IRC & IS codes.**

Note: Self-study for 5 marks only in CIE and not in SEECourse.

Course Outcome

After learning all the units of the course, the student is able to,

1. Identify site locations for the bridges.
2. Understand the IRC loadings.
3. Analyse and design of slab culvert.
4. Analyse and design of box culvert and T Beam Bridge.

Course Articulation Matrix

Sl. No.	Course Outcomes	Program Outcomes												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Identify site locations for the bridges	1	2											2		
2	Understand the IRC loadings.	1	2											1	1	
3	Analyse and design slab culvert.		2	2			2						2		2	2
4	Analyse and design box culvert and T beam bridge.		2	2			2						2		2	2

CourseTitle:PREFABRICATEDSTRUCTURES			
CourseCode:**P18CV742**	**Semester:VII**	**L-T-P-H -2-2-0-4**	**Credits:03**
ContactPeriod:52Hrs	**ExamHours:3Hrs**	**Weightage:CIE:50%,SEE:50%**	
Prerequisites: Strength of materials, Structural analysis			

CourseLearningObjectives(CLO's)

The main objective of this course is to,

1. Understand basic principles of modularconstruction andindustrializedconstruction
2. Understand the behavior of Structural components.
3. Designprefabricatedelements for Joint flexibility.
4. Understand the structural connection and Design of expansion joints.
5. Understand the effects Earthquakes,Cyclones,and importanceofavoidanceofprogressivecollapse

Course Content

Unit – I

INTRODUCTION: Needforprefabrication–Principles–Materials–Modularcoordination–Standardization–Systems–Production–Transportation–Erection.

12 Hrs

Self-Study Components: Erection using different methods.

Unit – II

PREFABRICATEDCOMPONENTS: Behaviorofstructuralcomponents–Large panel constructions–Constructionofroof andfloorslabs–Wallpanels–Columns–Shearwalls.

10 Hrs

Self-Study Components: Construction of Shear walls by recent technology

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Unit-III

DESIGN PROBLEMS: Jointflexibility–Allowanceforjointdeformation.

10 Hrs

Self-Study Components: Methods of Evaluation of Joint Flexibility

Unit-IV

JOINTINSTRUCTURALMEMBERS: Jointsfordifferentstructuralconnections–Dimensionsanddetailing–Designofexpansionjoints.

10Hrs

Self-Study Components: Methods of determination of expansion joints.

UNIT-V

EFFECTS: Earthquakes,Cyclones,etc.,Importanceofavoidanceofprogressivecollapse.

10 Hrs

Self-Study Components: Recent earthquakes and cyclones in India

Course Outcomes:

Afterstudyingthiscourse,studentswillbeableto:

1. Use modular construction, industrialized construction.
2. Analyze the behavior of prefabricated elements.
3. Design of elements for joint deformation and joint Flexibility.
4. Choose and suggest type of joint connections and detailing, understand importance of avoidance of progressive collapse.

Text Books:

1. CBRI,Buildingmaterialsandcomponents,India,1990
2. GerostizaC.Z.,HendriksonC.andRehatD.R.,"Knowledgebasedprocessplanningforconstructionand manufacturing",AcademicPressInc.,1994

Reference Books:

1. KonczT.,"Manualofprecastconcreteconstruction",Vol.I,IIandIII,Bauverlag,GMBH,1976.
2. "Structuraldesignmanual",Precastconcreteconnectiondetails,Societyforthestudiesintheuseofprecastconcrete,NetherlandBetorVerlag,2009

Note: Self-study for 5 marks only in CIE and not in SEE

CourseArticulationMatrix(CAM)

Sl no	CourseOutcomes(CO's)	Programoutcomes(PO's)												ProgramSpecificoutcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Usemodularconstruction,industrializedconstruction.	2													1	
2	Analyze the behavior of prefabricated elements.		2													1
3	Design of elements for joint deformation and joint Flexibility.			2												1
4	Choose and suggest type of joint connections and detailing, understand importance of avoidance of progressive collapse.	1	1												1	1

CourseTitle:OPEN CHANNEL HYDRAUILCS			
CourseCode:P18CV743	**Semester:VII**	**L-T-P-H -2-2-0-4**	**Credits:03**
ContactPeriod:52Hrs	**ExamHours:3Hrs**	**Weightage:CIE:50%,SEE:50%**	
Prerequisites: Fluid Mechanics , Hydraulics			

CourseLearningObjectives(CLO's)

The main objective of this course is to,

1. Understandthechannelclassifications,conservationequationsformass,momentum and kinetic energy in open channel flow, design of channels for uniformflow andstandardchannelsections.
2. Understandtheconceptsofcriticaldepthinvariouschannelsections,differentmethodstoanalyzetheproblemsingraduallyvariedflowandrapidlyvariedflow.
3. Understanddynamicequationforwiderectangularchannels,classificationofchannelbottomslopes,watersurfaceprofilesindifferentslopedchannels,
4. Understandthecharacteristicsofhydraulicjumpsinrapidlyvariedflowandexponentialchannels,tailwatercurveandjumpwatercurve.
5. Understand the application of hydraulic jump as energy dissipater and in variousstillingbasins,designofcrestprofileofspillway

Course content

UNIT-I

INTRODUCTION: Open channels, types, channels of first kind and channels of secondkind, classification of flow, pressure and velocity distribution in open channel flow,
energyequation,momentumequation,kineticenergyandmomentumfactors,Numericals.
UNIFORMFLOW: Concepts,uniformflowequations,conveyanceofchannelsection,sectionfactorforuniformflow,Normalslopeandcriticalslope,hydraulicexponentforuniformflow,designofchannelsforuniformflow,standardchannelsections,Numericals.

10Hrs

Self-StudyComponent: Surgesinopenchannels

UNIT-II

CRITICAL FLOW: Concept of specific Energy – Control sections. Calculation of criticaldepthforrectangular,triangular,circularandtrapezoidalsections,Designofchannel, SectionFactorforcriticalflow,Hydraulicexponentforcriticalflow,criticaldepthasaflow measurement,problems.
GRADUALLYVARIEDFLOW: Concepts,GVFequation,itsdifferentforms,Basicassumptions,Dynamicequationforwiderectangularchannels,classificationofchannelbottomslopes,classificationofwatersurfaceprofilesindifferentslopedchannels,Numericals.

11Hrs

Self-StudyComponent: ControlSections

UNIT-III

GRADUALLYVARIEDFLOWCOMPUTATIONS- Different methods,direct integration method-Chow's solution, Bresse's Solution, direct step method, standard

step method and graphicalintegrationmethod.Problems.

11Hrs

Self-StudyComponent: Application of AI in generating Backwater Curvesinnaturalchannels

UNIT-IV

RAPIDLY VARIED FLOW: Concepts, hydraulic jump in rectangular channels, classificationofhydraulic jump based onFroude's number, characteristicsof hydraulic jump, Tail watercurveandjumpwatercurve,classificationofhydraulicjumpbasedontailwaterdepth, Numericals.

10Hrs

Self-StudyComponent: Hydraulic Jumps in Sloped Channels.

UNIT-V

STILLING BASINS & SPILLWAYS: ApplicationofHydraulicjumpasenergydissipater,Stillingbasins–type-IIandtype–IV,Spillways: Location of Spillway, Types of Spillways, Design consideration of overflowspillways(ogeespillway)–designofcrestprofile, Design of Syphon spillway,Numericals.

10Hrs

Self-StudyComponent: Hydraulic Jump in Non-rectangular channels

TextBooks:

1 HydraulicsandFluidMechanicsincludingHydraulicMachines.Dr.PNModiandDr.S MSeth,Standard Bookhouse,NewDelhi.
2 FlowthroughOpenChannel:RGRangaraju:TataMcGrawHillPublishingCoLtd,NewDelhi.
3 OpenChannelHydraulics:KSubramanya:TataMcGrawHillPublishingCoLtd,NewDelhi
4 Irrigation Engineering and Hydraulic Structures: S. K Garg, Khanna Publishers, Delhi

ReferenceBooks:

1 OpenChannelHydraulics:VenTeeChow:McGrawHillBookCompany,NewDelhi.
2 OpenChannelHydraulics:French:McGrawHillBookCompany,NewDelhi.
3 FluidMechanics:ModiandSeth:StandardBookHome,NewDelhi.
4 OpenChannelHydraulics:Henderson:Mr.MillanPublishingCo.Ltd.,NewYork.

Note:Self-studyfor5marksonlyinCIEandnotinSEE

CourseOutcomes

Afterstudyingthiscourse,studentswillbeableto:

1. Apply the knowledge of fluid mechanics, conservation equations for mass, momentum, and energy to develop a strong knowledge of open channel flow.
2. Analyze and compute flow profiles using various methods.

3. Develop and apply mathematical relationships for hydraulic jumps, critical, uniform, gradually-varying flow and rapidly varied flow.
4. Knowledge of open channel flow in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs.

CourseArticulationMatrix(CAM)

Sl no	**CourseOutcomes**	**Programoutcomes**												**ProgramSpecificoutcomes**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Toapplytheknowledgeoffluidmechanics,conservationequationsfor mass, momentum, and energy todevelopastrongknowledgeofopen Channelflow.	2												2		
2	ToAnalyze and compute flow Profilesusingvariousmethods.		2	2											2	
3	To develop and apply mathematicalrelationshipsforhydraulicjumps,critical,uniform,gradually-varying Flowandrapidlyvariedflow.		2												2	
4	Applytheknowledgeofopenchannelflowinfuturetoworkeffectively either as an individual orasateammembertosatisfythechangingprofessionalandsocietal Needs.	2	1													2

Course Title: ADVANCED FOUNDATION DESIGN			
Course Code: P18CV744	**Semester: VII**	**L-T-P-H -2-2-0-4**	**Credits : 03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Geo-technical Engineering.			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Design shallow foundation
2. Design pile and well foundation
3. Understand the requirement of foundation on expansive soil
4. Know about machine foundation
5. Learn about soil dynamics

Course Content

UNIT – I

SHALLOW FOUNDATIONS: Presumptive bearing capacity according to BIS, Factors affecting bearing capacity, Factors influencing selection of depth of foundation, types of shallow foundations and Settlement of Shallow Foundations: Immediate, consolidation, & differential settlements. Principles of Design of footing, Proportioning of footings for equal settlement. Design of isolated footing, combined footing.

10 Hrs

Self-Study Component: - Design of Strap footing, Strip footing and Raft.

UNIT – II

PILE FOUNDATIONS: Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Pile Groups: Introduction, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction & under reamed piles.

10 Hrs

Self-Study Component: - settlement of under reamed piles.

UNIT – III

WELL FOUNDATIONS: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells, Causes and remedies of tilts and shifts. Drilled piers: Introduction and construction.

10 Hrs

Self-Study Component:-Advantages and disadvantages of drilled piers.

UNIT – IV

FOUNDATIONS ON EXPANSIVE SOILS: Introduction, Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and swell pressure, free swell, CNS layer, foundation treatment for structures in expansive soil. Caissons:Design of open, pneumatic and floating caissons.

10 Hrs

Self-Study Component:-Advantages and disadvantages of floating caissons

UNIT – V

MACHINE FOUNDATIONS: Introduction, Types of Machine foundations, basic definitions, degree of freedom of a block foundation, general criteria for design of machine foundation, free and forced vibrations, vibration analysis of a machine foundation, determination of natural frequency.

12 Hrs

Self-Study Component:-Vibration isolation and control

Text Book:

1. **Soil Mechanics & Foundation Engineering** - V.N.S. Murthy -Pub: Sai Tech.
2. **Soil Mechanics Foundations** - Dr. B.C. Punmia -Pub :Laxmi publications, pvt. Ltd.
3. **Soil Mechanics and foundation Engineering**- K.R. Arrora&A.K.Jain for standard publishers & Distributors.

REFERENCE BOOKS:

1. Pile Foundation.-Chellies, McGraw Hill Book Co., Inc., New York, 1951. 64.
2. Geotechnical Engineering.- P. Purushotham Raj, Pearson Publishers

Note: Self studyfor 5 marks only in CIE and not in SEE

Course Outcomes (CO's)

Afterstudyingthiscourse,studentswillbeableto:

1. .Apply the knowledge of Geology and geotechnics to differentiate shallow & deep foundation
2. Analyze shallow and deep foundations for civil engineering structures
3. Evaluate Design shallow and deep foundation for civil engineering structures
4. Interpret data to select suitable foundation for expansive soil from safety consideration.

Course Articulation Matrix																
Sl.No.	**Course Outcomes**	**Program Outcomes**												**Program Specific Outcomes**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of Geology and geo technics to differentiate shallow & deep foundation	2												2		
2	Analyze shallow and deep foundations for civil engineering structures		2												2	
3	Evaluate Design shallow and deep foundation for civil engineering structures			2											2	
4	Interpret data to select suitable foundation for expansive soil from safety consideration				2		1									1

Course Title: ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code: P18CVO751	**Semester: VII**	**L - T – P : H :3-0–0: 3**	**Credits : 03**
Contact Period: Lecture: 52 Hr	**Exam Hours :03 Hr**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Nil			

Course Learning Objectives (CLOs):

The main objective of this course is to,

1. Understand the procedure of conducting EIA

2. Analyze different methods of EIA

3. Conduct EIA for water, air and noise environment

4. Appreciate the need for public participation in EIA

5. Enumerate the method of conducting EIA for water resource project, Highway project, Iron mining project

Course Content

UNIT –I

INTRODUCTION: Basic concept of EIA, Definition of EIA, Elements of EIA,need for EIA, EIS, FONSI, Utility of EIA, Scope of EIA, Step by step procedure of conducting EIA, REIA, CEIA, Limitations of EIA,

Self-study component: Frame work of EIA **12Hrs**

UNIT –II

E I A Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/Benefit Analysis.

Self study component: cost/Benefit Analysis. **10Hrs**

UNIT -III

Environmental Audit & Environmental legislation:Objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, on-site activities, evaluation of Audit data and preparation of Audit report.

Post Audit activities: The Environmental pollution Act, The water; Act, The Air (Prevention & Control of pollution Act.), Mota Act. Wild life Act.

10Hrs

Self study component: Biodiversity Rules, 2004.

UNIT -IV

ASSESSMENT AND PREDICTION OF IMPACTS ON ATTRIBUTES –
Prediction and assessment of impacts of developmental activities on surface water, land and soil, groundwater, air, biological environment etc. Prediction and assessment of visual impacts, socioeconomic impact analysis, Evaluation of alternatives, preparing the EIA document, Environmental impact statement (EIS),

10Hrs

Self-study component: Causes and effects of deforestation.

UNIT –V

EIA Case Studies and Public participation
Case studies on -Thermal Power Plant, Mining, Fertilizer, Construction Projects, Public participation in environmental decision making, objectives of public participation and public participation techniques. Practical consideration in preparing in EIA and EIS

10Hrs

Self-study component: :EIA Guidelines for developmental projects

Text Books
1. **"Environment Assessment Methodologies"** Y. Anjaneyulu and ValliManickam, B.S Publications, Hyderabad, 2007.
2. **"Environmental Impact Analysis"** R.K Jain, VanNostrand, - Reinhold Company, 1977.

Reference Books:
1. **"Environmental Impact Assessment" S. S**Larry W Canter, –McGraw – Hill International Editions, 1996.
2. Guidelines for EIA of Developmental Projects, Minister of Environment and Forests, GOI.

Course outcomes

Afterstudyingthiscourse,studentswillbeableto:

1. Understand the strengths of EIA in regard to environmental management. Appreciate the purpose and role of EIA in the decision-making process. Understand the technical and social/political limitations of EIA
2. Understand the Environmental Acts of India
3. Understand the Screening process, scoping process and how we applied in the different projects.
4. Assess and Predict Impacts on Attributes and have knowledge of EIA Report (Environmental Impact Statement, or Environmental Statement)

Course Articulation Matrix (CAM)

Sl.No	Course Outcome	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand the strengths of EIA in regard to environmental management .Appreciate the purpose and role of EIA in the decision-making process. Understand the technical and social/political limitations of EIA.	1	2												1	
2	Understand the Environmental Act of India.	1	1	2										1		
3	Understand the Screening process, scoping process and how we applied in the different projects.		2	1											2	
4	Assess and Predict Impacts on Attributes and have knowledge **of** EIA Report (Environmental Impact Statement, or Environmental Statement)		1	2										1		

Course Title : ATMOSPHERIC ENVIRONMENTAL POLLUTION AND CONTROL			
Course Code: P18CVO752	**Semester: VII**	**L - T – P : H : 3-0–0-3**	**Credits : 03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Nil.			

Course Learning Objectives (CLOs):

The main objective of this course is to,

1. Understand the knowledge of Air Pollution, characterization and classification.
2. Effects of Meteorology on Air pollution-Fundamentals.
3. Understand the Monitoring of Particulate matter.
4. Knowledge of air pollution controlling equipment.
5. Understand the effects of Indoor Air Pollution.

Course Content

UNIT –I

Introduction: Definition of Air Pollution, sources, characterization and classification of atmospheric pollutants, air pollution episodes. Effects of air pollutants on human health, vegetation, animals and materials and monuments. Composition and structure of the atmosphere;Visibility and other related atmospheric characteristics.

12Hrs

Self-studycomponent :Visibility and other related atmospheric characteristics.

UNIT -II

Meteorology: Effects of Meteorology on Air pollution-Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns-Atmospheric Diffusion Theories-Dispersion models, plume rise.

10Hrs

Self-study component: gas exhaust analyzer. Air Pollution Index.

UNIT -III

Monitoring of particulate matter: Respirable, non-respirable and nano - particulate matter. Monitoring of gaseous pollutants – CO, CO2, Hydrocarbons, SOX and NOX, photochemical oxidants. Monitoring equipment and sampling devices – stack sampling (Isokinetic sampling), air samplers,as exhaustanalyzer.AirPollution Index

10Hrs

Self-study component: plume rise and effective stack height calculations.

UNIT -IV

Air Pollution Control Equipment: Mechanisms, Control equipment for particulate matter – gravity settling chambers, centrifugal collectors, wet collectors, scrubbers, fabric filters, electrostatic precipitator (ESP) - Design principles and criteria with design

Control Equipment for gaseous pollutants – adsorption,absorption,condensation and combustion. Design principles.

10Hrs

Self-study component: absorption, condensation and combustion. Design principles.

UNIT -V

Indoor Air Pollution: Sources, indoor air contaminants, effects and control. Air changes per hour (ACH), IAQ Standards

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise

Self-study component: Legal aspects of noise **10Hrs**

Text Books:

1. M. N. Rao and H V N Rao, Air pollution, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, Air pollution. Tata McGraw Hill Publication.Mackenzie Davis and David Cornwell, Introduction t o Environmental Engineering McGraw-Hill Co.

REFERENCES

1. Crawford, M., (1980),“ Air Pollution Control Theory”- TATA McGrawHill.
2. Howard S. Peavy, Donald R. Rowe and George Technobanoglous., (2017) “Environmental Engineering” – McGraw Hill InternationalPublications.
3. Stern, A.C., Air Pollution, VolI, II,III.
4. Stern, A. C., (1977), “Air Pollution : The Effects of Air Pollution” – 3rd-Edition,Academic Press

Note: Self studyfor 5 marks only in CIE and not in SEE

Course Outcomes

Afterstudyingthiscourse,studentswillbeableto:

1. Understand the importance of composition and structure of atmosphere, sources, classification,
effects of air pollutants, and measurement of air pollutants, air pollution standards and control regulations.
2. Understand the basic concepts of various meteorological factors which influence the dispersion of air pollutants and to create wind rose diagram, Gain Knowledge about the monitoring of particulate matter.
3. Prediction of dispersion of air pollutants using different models and to evaluate the plume rise using various model equations and get a fair knowledge on stack sampling.
4. Understand and analyze the basic mechanisms involved, working principles and design aspects of various air pollution controlling equipment’s through demonstration.Understand the concept of Indoor Air Pollution and Noise Source and Control

Course Articulation Matrix (CAM)																
Sl.No	**Course Outcome**	**Program outcome**											**Program Specific outcome**			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand the importance of composition and structure of atmosphere, sources, classification,effects of air pollutants, and measurement of air pollutants, air pollution standards and control regulations.	2	1											1		
2	Understand the basic concepts of various meteorological factors which influence the dispersion of air pollutants and to create wind rose diagram, Gain Knowledge about the monitoring of particulate matter.			1											2	
3	Prediction of dispersion of air pollutants using different models and to evaluate the plume rise using various model equations and get a fair knowledge on stack sampling.	1	2	1										2		
4	Understand and analyze the basic mechanisms involved, working principles and design aspects of various air pollution controlling equipment's through demonstration. Understand the concept of Indoor Air Pollution and Noise Source and Control.	2	1		1										1	

Course : BUILDING SERVICES			
Course Code: P18CVO753	**Semester: VII**	**L - T – P : H : 3-0–0: 3**	**Credits : 03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites : Nil			

Course Learning Objectives (CLO's)

The main objective of this course is to,

1. Gain the knowledge of different building services and their types used in buildings.
2. Understand requirements and constraints in providing building services suitable for buildings.
3. Determine design factors of building services suitable for buildings.
4. Understand concepts of Elevators & Escalators, their types, working principle & design principles and type of energy conservation technologies suitable for buildings.
5. Determine factors of building services like ventilation, thermal comfort & illumination in buildings.

Course content

UNIT - I

VENTILATION: Definition, Necessity, Functional Requirements of Ventilation, Types of Ventilation- Natural Ventilation and Artificial Ventilation. Sound Amplification Equipments- Necessity, Factors affecting, Mechanism of sound amplification.

Thermal comfort in buildings: Factors affecting, heat transfer through buildings, thermal properties of building materials, insulation materials for buildings. Communication systems- terminologies, necessity, systems of communication.

12 Hrs

Self study component: Types of sound amplification equipments.

UNIT - II

ELECTRICAL WIRING: Planning of Electrical Supply System, - Systems of wiring- domestic and commercial buildings, - Materials and Devices used in Wiring. Earthing- Procedure and Types, Inspection and Testing of Installation, Electrical Supply layout and conventional symbols of electrical items.

Fire protection: Necessity, fire hazards, characteristics and types of fire resistant materials, fire load and its calculation, fire resistant construction – walls and columns, floors and roofs, wall openings, escape elements and strong room construction, fire protection equipment.

10 Hrs

Self study component: General fire safety requirements.

UNIT - III

ILLUMINATION OF BUILDINGS: Definition, laws of illumination, principles of illumination, artificial lighting, day lighting, flood lighting, Introduction to various types of lamps.

Acoustics:-Definition of terminologies, Behaviour of Sound in enclosures, Acoustic materials-properties, Acoustical Defects & Remedies, design of assembly halls, theatre.

10 Hrs

Self study component: Auditorium and musical Studio.

UNIT - IV

NOISE CONTROL IN BUILDINGS: Sound insulation-Materials, Types- Horizontal Barriers & Vertical Barriers.**Elevators** – Components of a typical elevator, types, working principle, principles of design of an elevator.**Escalator**: Necessity, Components of a typical escalator, working principle.

10 Hrs

Self study component: Design considerations of escalator.

UNIT - V

ENERGY CONSERVATION IN BUILDINGS: Necessity, Advantages and Limitations , Introduction to Zero Energy Buildings& Green Buildings , Energy efficient building design-Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation.

10 Hrs

Self study component:LEED Certification for buildings.

TEXT BOOKS:

1. Mechanical and Electrical Systems in Buildings, by Tao, Prentice Hall publications
2. Building construction by B.C.Punmia, Laxmi Publications.
3. A Text Book on Building Construction by P.C.Varghese, Prentice Hall of India publications
4. Architectural Lighting by Bran David.
5. Acoustics and noise control-theory, design by S.K.Kandaswamy(Ed), practice-allied publishers

REFERENCE BOOKS:

1. Mechanical Services for Buildings by Eastop, Longman Publications.
2. IS SP41and SP32-hand book on functional requirements of buildings.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes:

After studying this course, students will be able to;

1. Prepare the design factors for providing ventilation, thermal comfort & in construction of buildings.
2. Interpret the knowledge of design factors of electric and fire protection in building construction.
3. Prepare the design factors for providing illumination, acoustics and noise control construction of buildings.
4. Choose & suggest type of elevators & escalators based on working principle & design principles.

Course Articulation Matrix (CAM)

Sl.No	Course Outcomes	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Prepare the design factors for providing ventilation, thermal comfort & in construction of buildings.	1													2	
02	Interpret the knowledge of design factors of electric and fire protection in building construction	1	1											2		
03	Prepare the design factors for providing illumination, acoustics and noise control construction of buildings.		2												2	
04	Choose & suggest type of elevators & escalators based on working principle & design principles.	1													2	

Course Title:REMOTE SENSING AND INTRODUCTION TO GEOINFORMATICS			
Course Code: P18CVO754	**Semester: VII**	**L - T – P : H : 3-0–0:3**	**Credits :03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites : Nil			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Gain knowledge about advantages of using remote sensing over conventional methods, electromagnetic radiation and its various interactions and to understand the concept of GIS and GPS.
2. Acquire knowledge about active and passive sensors and various earth resource satellites - IRS, LANDSAT, SPOT, ENVISAT, CARTOSAT, RESOURCESAT, IKONOS, etc.
3. Learn image enhancements; interpret visual image and digital image processing and analysis of accuracy assessment of image classification.
4. Understand basic components of GIS and GPS and to analyze their work flow.
5. Apply the knowledge of Remote Sensing, GIS and GPS in various Engineering domains.

Course Content

UNIT– I

CONCEPTS AND FOUNDATIONS OF REMOTE SENSING: Introduction, definitions of remote sensing, energy sources and radiation principles, electromagnetic energy, electromagnetic spectrum, black body radiation, energy interactions in the atmosphere, energy interactions with earth surface features, spectral reflectance of vegetation, soil and water, atmospheric influences on spectral response patterns, an ideal remote sensing system, characteristics of real remote sensing, data acquisition and interpretation, applications remote sensing.

12 Hrs

Self Studycomponent: Acquisition of reference data**,** spectral reflectance curves.

UNIT– II

REMOTE SENSING PLATFORMS AND SENSORS: Remote sensing platforms, satellites and orbits, geostationary and sun synchronous satellites, earth resource satellites- IRS, LANDSAT, SPOT, ENVISAT, CARTOSAT, RESOURCESAT, IKONOS etc. Sensors- active and passive sensors, sensor resolutions, (spectral, spatial, radiometric and temporal) Creation of remote sensing data, Digital and photographic data. panchromatic, multispectral and hyper spectral data.

10 Hrs

Self Study component: Indian and other major Earth resource satellites.

UNIT– III

VISUAL IMAGE INTERPRETATION AND DIGITAL IMAGE PROCESSING: Elements of visual image interpretation, image display and band combinations, true and false color composites, image histogram, image rectification and restoration, geometric correction, radiometric correction, Image enhancement, Image classification (Brief introduction only)- supervised and unsupervised, accuracy assessment of image classification. Image filtering- Low pass & high pass filters.

10 Hrs

Self-Study Component: Classification of mixed pixels, spectral rationing.

UNIT– IV

FUNDAMENTALS OF GEOGRAPHIC INFORMATION SYSTEM: Introduction, basics of GIS- definition of GIS, components of GIS, GIS work flow, GIS functions, and representing spatial data, Raster and vector data. Coordinate systems and map projections, spatial data, Non spatial data.GIS applications.

10 Hrs

Self-Study Component: Database models and management

UNIT– V

GLOBAL POSITIONING SYSTEM: Introduction, definition, components of GPS, operational principle, facts and limitations of GPS, GPS receivers, differential GPS, types of DGPS, GPS applications.

APPLICATIONS OF GIS: Use of RS & GIS in Water Resources, Natural Hazards, Agriculture, Mining.

10 Hrs

Self-Study Component: Map numbering, map projection and classification of map projections.

TEXT BOOKS:

1. Lillesand T.M., and R.W. Kiefer, ―Remote sensing and Image interpretation", 5th edition, John Wiley & Sons – 2014.
2. Manoj K. Arora, R.C. Badjatia, "Geomatics Engineering", Nemichand& Bros. Roorkee – 2011.
3. G.S Srivastava, "Introduction to Geoinfomatics" McGraw hill - New Dehli -2014.

REFERENCE BOOKS:

1. Carcknell Arthur P.et.al – Introduction to remote sensing, 2nd edition - 2009
2. Introduction to GIS-Kang tsuang Chang- tata McGraw hill, New Dehli 2009.
3. Peter A. Burrough& Rachel A. McDonnel "Principles of geographic information systems"-(1998), Oxford University press, Great Britain.
4. Chang, "Geographical Information Systems", McGraw Hill Book Co., 2007.

5. Kang - Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.

Note: Self studyfor 5 marks only in CIE and not in SEE

Course outcomes

After studying this course, students will be able to;

1. Apply the knowledge of basic science and Engineering to understand the advantages of using remote sensing over conventional methods, electromagnetic radiation and its various interactions and to understand the concept of GIS and GPS.
2. Understand the various sensors and platforms used in remote sensing and identify the earth surface features from satellite images, creation of remote sensing data.
3. To interpret visual image and digital image processing and analysis of accuracy assessment of image classification.
4. Understand basic components of GIS and GPS and to analyze their work flow and to understand how remote sensing, GIS and GPS are used in various Engineering applications.

Course Articulation Matrix

Sl.no	Course Outcomes	Program Outcomes												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of basic science and Engineering to understand the advantages of using remote sensing over conventional methods, electromagnetic radiation and its various interactions and to understand the concept of GIS and GPS.	2												1		
2	Understand the various sensors and platforms used in remote sensing and identify the earth surface features from satellite images, creation of remote sensing data.	1	2											1		
3	To interpret visual image and digital image processing and analysis of accuracy assessment of image classification.	2												2		
4	Understand basic components of GIS and GPS and to analyze their work flow and to understand how remote sensing, GIS and GPS are used in various Engineering applications.	2	2											1		

Course Title: ENVIRONEMENTAL ENGINEERING LABORATORY			
Course Code: P18CVL76	**Semester: VII**	**L - T – P : H : 0-0-3 : 3**	**Credits :1.5**
Contact Period: Lecture: 39Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites : Environmental Engineering			

Course Learning Objectives (CLOs)

To learn the basic test involved in determination of properties of water

Course Content

1	Determination of Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.	3 Hr
2	Electrical conductivity. Determination of Chlorides and Sulphates	3 Hr
3	Determination of Alkalinity, Acidity and pH.	3 Hr
4	Determination of Calcium, Magnesium and Total Hardness.	3 Hr
5	Determination of Dissolved Oxygen. Determination of BOD.	3 Hr
6	Determination of COD.	3 Hr
7	Determination of percentage of available chlorine in bleaching powder, Residual Chlorine and Chlorine Demand.	3 Hr
8	Jar Test for Optimum Dosage of Alum, Turbidity determination by Nephelometer.	3 Hr
9	Determination of Iron. Phenanthroline method.	3 Hr
10	Determination of Fluorides SPANDS Method.	3 Hr
11	MPN Determination	3 Hr
12	Determination Nitrates by spectrophotometer.	3 Hr
13	Determination of sodium and potassium by flame photometer	3 Hr

REFERENCE BOOKS:

1. Manual of Water and Wastewater Analysis – NEERI Publication.

2. Standard Methods for Examination of Water and Wastewater (1995), American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC.

1. **IS Standards:** 10500-2012, 2490-1974, 3360-1974, 3307-1974.
2. **Chemistry for Environment Engineering**. Sawyer and McCarthy

Course Outcome

After studying this course, students will be able to;

1. Apply the knowledge of science and engineering for testing water and wastewater qualities
2. Testing water qualities from health criteria and legal standards
3. Test sewage characteristics and to compare with legal standards.
4. Interpret the test data for design of water and wastewater treatment units.

Course Articulation Matrix (CAM)																
Sl. No	**Course Outcomes**	**Program outcome**												**Program specific outcomes**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of science and engineering for testing water and wastewater qualities	2												2		
2	Testing water qualities from health criteria and legal standards				2		2								2	
3	Test sewage characteristics and to compare with legal standards.				2		2								2	
4	Interpret the test data for design of water and wastewater treatment units			2	2										2	

Course Title: CAD LABORATORY –II			
Course Code: P18CVL77	**Semester: VII**	**L - T – P : H : 0-0-3: 3**	**Credits :1.5**
Contact Period: Lecture: 39 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Computer Aided Building Planning & Drawing, Design of RC / Steel Structures.			

Course learning objectives:

This course will enable students to

1. be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

PART-I

Detailing of RCC Structures

1. Beams – Simply supported, Cantilever and Continuous.
2. Slab – One way, Two way and One-way continuous.
3. Staircase – Doglegged
4. Column footing - Column and footing (Square and Rectangle).

(NOTE: Drawings to be prepared for given structural details. Also Bar Bending Schedule should be prepared for above drawings)

15Hrs

PART-II

Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.

(NOTE: Drawings to be prepared for given structural details)

15 Hrs

PART-III

Structural Software

Analysis of 2D structural systems using STAADPro. (Continuous beams, Frames and Trusses)

09 Hrs

Question paper pattern:

- Two questions shall be asked each from PART-I& II and student should answer any one.
- One full question should be answered from part-III.

Text Books:

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
2. IS 13920:2016, Ductile Design and Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code of Practice, Bureau of Indian Standard.

Course Outcomes (CO's)

After studying this course, students will be able to;

1. Draw detailed drawings of R.C beams, slabs element, staircase and column footing for given structural details as per codal provisions.
2. Draw detailed drawings of steel connections for simple beam to beam and built up columns and column bases, draw detailed drawings of simple beam to beam and built up columns and column bases for given structural details.
3. Analyse 2D structural systems using **STAAD Pro**. (Continuous beams, Frames and Trusses)

Course Articulation Matrix (CAM)

Sl. No	Course Outcomes	Programme outcome												Programme specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand basic concepts of beam, slab staircase and column footing, draw detailed drawings of beams, slabs element, staircase and column footing for given structural details.	1	2			3								1	2	
2	Understand basic concepts of steel connections for simple beam to beam and built up columns and column bases , draw detailed drawings of simple beam to beam and built up columns and column bases for given structural details.	1	2			2								1	2	
3	Analysis of 2D structural systems using STAAD Pro. (Continuous beams, Frames and Trusses)	1	2			3								1	2	

Course Title: Project Work Phase – I and Project Seminar			
Course Code: P18CV78	**Semester: VII**	**L:T:P:H: 0:0:0:4**	**Credits :02**
Weight age: CIE:100			

Project Work: The Project Work (Phase I + Phase II) carries 8 credits (2 credits+6 credits) and spreads over TWO semesters, i.e. during 7th and 8th semesters.

I. Project Phase – I and Project seminar Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and seminar presentation skill.

II. The Assessment marks (CIE) in the case of Project Work - Phase I, shall be based on the evaluation at the end of the 7th semester by a committee consisting of Head of the concerned department, two senior faculty members of the department, one of them may be the internal guide. The work may be evaluated by the committee for award of Assessment marks (CIE) based on a Report [comprising of synopsis, Introduction, Literature survey, Objective and Methodology], presentation and viva voce.

III. The project work shall be carried out by candidate(s) independently/in a group (maximum of four) during the seventh and eighth semester under the guidance of one of the faculty members of the Department of study. If the project work is of inter-disciplinary nature, a co-guide shall be taken from the same or any other relevant Department. If a project work has to be carried out in any industry / factory / organization, outside the campus, the permission for the same and the name of co-guide at any of these organizations shall be intimated to the authorities at the beginning of seventh semester by the Head of the Department.

Course Title: PRESTRESSED CONCRETE STRUCTURES			
Course Code: P18CV81	**Semester: VIII**	**L - T – P : H : 4-0–0:4**	**Credits : 04**
Contact Period: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50%; SEE:50%**	
Prerequisites : Strength of Materials, Design of R.C.C. Structures			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Understand the technique behind Pre-stressing of rectangular beams, I-sections,T-sections.
2. Analyze the Pre-Stressing Beams at transfer and at working.
3. Determine the losses and deflection occurring in PSC members due to various factors.
4. Study the different types of composite beam and its behavior in flexure and shear.
5. Design the End Block of PSC beams and PSC beams for flexure.

Course Content

UNIT- I

MATERIALS, BASIC PRINCIPLES OF PRESTRESSING:
High strength concrete and steel, Stress-Strain characteristics and properties, Pre-tensioning and Post-tensioning systems, Cable profiles, Load balancing concept, Centre of Thrust, pressure line.

10 Hrs

Self-study component: End anchorages of Post-tensioning systems.Kern zone, Cracking Moment.

UNIT- II

ANALYSIS OF SECTIONS FOR FLEXURE:
Stresses in concrete due to pre-stress and loads for different types of cross sections.

10 Hrs

Self-study component: Stresses in steel due to loads, Numericals.

UNIT- III

LOSSES OF PRE-STRESS & DEFLECTIONS:
Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force. Deflections of pre-stressed members, Short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflections limits as per IS 1343-2012. Effect of creep on deflection.

12 Hrs

Self-study component: Total losses allowed for design, Load verses deflection curve, methods of reducing deflection, crack widths.

UNIT- IV

LIMIT STATE OF COLLAPSE:

Flexure: IS code recommendations, Ultimate flexural strength of sections.

Shear: IS code recommendations, shear resistance of sections, shear reinforcement.

10 Hrs

Self-study component: Numericals.

UNIT- V

DESIGN OF END BLOCKS:

Transmission of prestress in pretensioned members, transmission length, anchorage stress in post-tensioned members. Bearing stress and bursting tensile force – stresses in end blocks-methods, IS code method provision for the design of end block reinforcement.

10 Hrs

Self-studycomponent: Numericals.

Text Books:

1. N Krishna Raju, **"Pre - stressed Concrete",** Tata Mcgraw Hill, New Delhi
2. N Rajagopalan, **"Pre - stressed Concrete"**, Narosa Publishing House, New Delhi

Reference Books:

1. Lin T Y and N H Burns, **"Design of Pre - stressed Concrete Structures"**, John Wiley and Sons, New York
2. G S Pundit and S P Gupta, **"Pre - stressed Concrete"**, C B S Publishers, New Delhi

Note: Self-study is for 5 marks only in CIE and not in SEE

Course outcomes

After studying this course, students will be able to;

1. Apply the knowledge of the principles of Prestressing.
2. Analyze the stresses in PSC members under flexure.
3. Evaluate various losses, deflection in members, flexural strength, shear strength and principal tensile stresses in PSC members.
4. Design PSC beams for shear and End block design as per codal provisions.

Course Articulation Matrix (CAM)																
Sl.no	**Course Outcomes (CO)**	**Program Outcomes**												**Program Specific Outcomes**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of the principles of Prestressing.	2	2											2		
2	Analyze the stresses in PSC members under flexure.	2	2											2	2	
3	Evaluate various losses, deflection in members, flexural strength, shear strength and principal tensile stresses in PSC members.	1		2										2	2	
4	Design PSC beams for shear and End block design as per codal provisions.	2		2										2	2	

Course Title: EARTHQUAKE RESISTANT DESIGN OF STRUCTURES			
Course Code: P18CV821	**Semester: VIII**	**L-T-P-H -2-2-0-4**	**Credits: 03**
Contact Period :52Hrs	**Exam: 03 Hrs**	**Weightage: CIE: 50 %; SEE: 50%**	
Prerequisites: Strength of Materials, Design of RCC Structures.			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Fundamentals of engineering seismology.
2. Irregularities in building which are detrimental to its earthquake performance.
3. Computation of seismic lateral forces for framed and masonry structures.
4. Geotechnical consideration and ductile detailing of RCC building.
5. Retrofitting strategies of RC and Masonry building.

Course Content

UNIT - I

ENGINEERING SEISMOLOGY: Definitions, Classification of Earthquakes, Causes of Earthquakes, Internal structure of earth, Seismic waves, Theory of plate tectonics and seismic zoning of India, Intensity of earthquake and Magnitude of earth quake, Seismographs.
Earthquake Effects on Structures:Local site effects on behavior of building during earthquake, Earthquake monitoring and seismic instrumentation.

10Hrs

Self-study Component: Torsional response of buildings, concept of response Spectrum analysis.

UNIT - II

BUILDING CONFIGURATION: Vertical irregularity and plan configuration problems, Seismo-resistant building architecture lateral load resistant systems, Continuous load path, Building characteristics, and other cause of damages. Lessons Learnt from Past Earthquakes on the Performance of the Buildings Effect of Structural Irregularities on seismic performance of RC buildings.

10 Hrs

Self-study Component: Do's and Don'ts for protection of life and property.

UNIT - III

CONCEPTS OF EARTHQUAKE RESISTANT DESIGN: Philosophy and principle of Earthquakes Resistant Design, Guidelines for Earthquakes Resistant Design, Structural system, types of buildings for seismic resistance. Failure mechanisms of in filled frame, analysis of in filled frames, Evaluation of Earthquake forces as per IS: 1893-part-I-2016.

10 Hrs

Self-study Component: Numericals.

UNIT - IV

EARTHQUAKE RESISTANT DESIGN OF RCC BUILDINGS– Ductility Considerations, requirement for ductility, Ductility ratio, structural ductility and factors affecting ductility, Ductile detailing of RC structures as per IS:13920-1993.

Geotechnical Earthquake Engineering: Dynamic behavior of soil, Dynamic design parameters of soil, Soil-structure interaction. Liquefaction, factors affecting liquefaction, effects and remedial

measures.

12 Hrs

Self-study Component: Confinement of concrete, special confining reinforcement,Geotechnical failure of foundations during earthquake.

UNIT - V

SEISMIC BASE ISOLATION AND RETROFITTING: Basic concept of seismic base isolation-Seismic Isolation systems. Seismic retrofitting strategies of RC buildings, Retrofitting of Masonry buildings.

10 Hrs

Self-study Component: Necessity of seismic evaluation, Methods of seismic evaluation.

TEXT BOOKS:

1. PankajAgarwal and Manish Shrikhande, Earthquake resistant design of structures, PHI, India.
2.S.K.Duggal, Earthquake resistant design of structures, Oxford university press, 2007.

REFERENCE BOOKS:

1.Chopra, A.K. Dynamics of structures, Prentice-Hall of India Pvt. Ltd. New Delhi.
2. S. R. Damodaraswamy and S. Kavitha, Basics of Structural Dynamics and Aseismic design, PHI Learning Private Limited, New Delhi.
3. IS-1893 – 2016(Part-I), Indian Standard Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi.

Note: Self-study for 5 marks only in CIE and not in SEE

Course Outcomes:

After studying this course, students will be able to;

1. . Understand the basic knowledge of earth quakes and it's relation to structural systems
2. Apply the knowledge of engineering to conceptually design of structural systems against earthquakes.
3. Analyze and design of reinforced concrete structural systems subjected to earthquake forces
4. Summarize the retrofitting of RC and masonry structures.

Course Articulation Matrix (CAM)																
Sl.no	**Course Outcomes**	**Program Outcomes**												**Program Specific Outcomes**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand the basic knowledge of earth quakes and it's relation to structural systems	2	2											2		
2	Apply the knowledge of engineering to conceptually design of structural systems against earthquakes.	2		2										2	1	
3	Analyze and design of reinforced concrete structural systems subjected to earthquake forces		2	2										2	2	
4	Summarize the retrofitting of RC and Masonry structures	2		2										2		2

Course Title: GROUND IMPROVEMENT TECHNIQUES			
Course Code: P18CV822	**Semester: VIII**	**L-T-P-H -2-2-0-4**	**Credits :03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weight age: CIE:50; SEE:50**	
Prerequisites : Geotechnical Engineering			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Study and understand the concepts of ground improvement techniques, mechanical modification and chemical modification for different types of soil.
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

Course Content

UNIT – I

GROUND IMPROVEMENT: Definition, Objectives of soil improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique.

Mechanical modification:Type of mechanical modification, Aim of modification, compaction, Principle of modification for various types of soils.

Compaction**:** Effect of grain size distribution on compaction for various soil types like BC soil, lateritic soil, coarse-grained soil. Effect of compaction on engineering behavior like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. Field compaction – static, dynamic, impact and vibratory type, Specification of compaction. Tolerance of compaction, Shallow and deep compaction.

10 Hrs

Self-Study Component:- Effect of grain size distribution on compaction for various soil types like BC soil, lateritic soil, coarse-grained soil.

UNIT – II

HYDRAULIC MODIFICATION: Definition, aim, principle, techniques. Gravity drain, lowering of water table, multistage well point, vacuum dewatering. Discharge equations.

Drainage & Preloading**:** Drainage of slopes, preloading, vertical drains, sand drains. Assessment of ground condition for preloading, Electro kinetic dewatering.

10 Hrs

Self-Study Component:-Design of dewatering system including pipe line effects of dewatering and pre-fabricated vertical drain

UNIT – III

CHEMICAL MODIFICATION-I: Definition, aim, special effects, and methods. Techniques – sandwich technique, admixtures, cement stabilization. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage. Criteria for cement stabilization.
Chemical Modification-II:Lime stabilization – suitability, process, special effects, criteria for lime stabilization. Other chemicals, chlorides, hydroxides, lignin, hydrofluoric acid. Properties of chemical components, reactions and effects.

10 Hrs

Self-Study Component:- Stabilization using Fly ash and bitumen, tar or asphalt in stabilization.

UNIT – IV

GROUTING: Introduction, Effect of grouting, Chemicals and materials used,Types of grouting. Grouting procedure. Applications of grouting.

Other methods:Introduction & concepts of Soil reinforcement, Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing.

10 Hrs

Self-Study Component: - Thermal methods of stabilization

UNIT – V

GEOSYNTHETICS: Introduction, Geosynthetics types-raw materials, woven, non-woven, knitted, bio-degradable, nets and girds, three-dimensional mats, composites, membranes, properties of geosynthetic- material and fiber properties, geometrical aspects, mechanical properties, hydraulic properties, durability, applications of geo-synthetics- separation, filtration and fluid transmission, reinforcement, containment and barriers.

12 Hrs

Self-Study Component:- Woven, non-woven, knitted, bio-degradable, nets and girds, three-dimensional mats.

TEXT BOOKS:

1. **Ground Improvement Techniques**- Purushothama Raj P. (1999), Laxmi Publications, New Delhi.
2. **Construction and Geotechnical Method in Foundation Engineering**, Koerner R.M. (1985) - McGraw Hill Pub. Co., New York.

REFERENCE BOOKS:

1. **Engineering principles of ground modification**- Manfred Hausmann(1990) - McGraw Hill Pub. Co., New York.
2. **Methods of treatment of unstable ground**- Bell, F. G. (1975) Butterworths, London.

Note: Self-study for 5 marks only in CIE and not in SEE

Course Outcome

After studying this course, students will be able to;

1. Apply the knowledge of Geology & Geotechnical Engineering in Ground improvement techniques
2. Analyze Mechanical Modification Techniques for soils
3. Investigate chemical modification techniques for soils
4. Select appropriate geo-synthetics and grouting methods for ground Improvements for sustainability.

Course Articulation Matrix																
Sl.no	**Course Outcomes**	**Program Outcomes**												**Program Specific Outcomes**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of Geology & Geotechnical Engineering in Ground improvement techniques	2												2		
2	Analyze Mechanical Modification Techniques for soils		2												2	
3	Investigate chemical modification techniques for soils				2											1
4	Select appropriate geo-synthetics and grouting methods for ground Improvements for sustainability							2						1		

Course Title :ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code: P18CV823	**Semester: VIII**	**L-T-P-H -2-2-0-4**	**Credits : 03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weightage: CIE:50; SEE:50**	
Prerequisites: Environmental Engineering			

Course Learning Objectives (CLOs):

1. The student will understand the procedure of conducting EIA

2. The student will be able to analyze different methods of EIA

3. The student will be able to conduct EIA for water, air and noise environment

4. The students will appreciate the need for public participation in EIA

5. The students will enumerate the method of conducting EIA for water resource project, Highway project, Iron mining project

Course Content

UNIT –I

INTRODUCTION: Basic concept of EIA, Definition of EIA, Elements of EIA,need for EIA, EIS, FONSI, Utility of EIA, Scope of EIA, Step by step procedure of conducting EIA, REIA, CEIA, Limitations of EIA,

12Hrs

Self-study component: Frame work of EIA

UNIT –II

E I A Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/Benefit Analysis.

10Hrs

Self-study component: cost/Benefit Analysis.

UNIT -III

Environmental Audit & Environmental legislation: Objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, on-site activities, evaluation of Audit data and preparation of Audit report.

Post Audit activities: The Environmental pollution Act, The water; Act, the Air (Prevention & Control of pollution Act.), Mota Act. Wild life Act.

10Hrs

Self-study component: Biodiversity Rules, 2004.

UNIT -IV

ASSESSMENT AND PREDICTION OF IMPACTS ON ATTRIBUTES –
Prediction and assessment of impacts of developmental activities on surface water, land and soil, groundwater, air, biological environment etc. Prediction and assessment of visual impacts, socioeconomic impact analysis, Evaluation of alternatives, preparing the EIA document, Environmental impact statement (EIS),

10Hrs

Self-study component: Causes and effects of deforestation.

UNIT –V

EIA Case Studies and Public participation
Case studies on -Thermal Power Plant, Mining, Fertilizer, Construction Projects, Public participation in environmental decision making, objectives of public participation and public participation techniques. Practical consideration in preparing in EIA and EIS

10Hrs

Self-study component: EIA Guidelines for developmental projects

Text Books
1. **"Environment Assessment Methodologies"** Y. Anjaneyulu and ValliManickam, B.S Publications, Hyderabad, 2007.
2. **"Environmental Impact Analysis"** R.K Jain, VanNostrand, - Reinhold Company, 1977.

Reference Books:
1. **"Environmental Impact Assessment" S. S**Larry W Canter, –McGraw – Hill International Editions, 1996.
2. Guidelines for EIA of Developmental Projects, Minister of Environment and Forests, GOI.

Note: Self-study for 5 marks only in CIE and not in SEE

Course outcomes

After studying this course, students will be able to;

1. Understand the strengths of EIA in regard to environmental management. Appreciate the purpose and role of EIA in the decision-makingprocess. Understand the technical and social/political limitations ofEIA
2. Understand the Environmental Acts of India
3. Understand the Screening process, scoping process and how we applied in the different projects.
4. Assess andPredict Impacts on Attributes and have knowledgeof EIA Report (Environmental Impact Statement, or Environmental Statement)

Course Articulation Matrix (CAM)																
Sl.No	**Course Outcome**	**Program outcome**												**Program Specific outcome**		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand the strengths of EIA in regard to environmental management .Appreciate the purpose and role of EIA in the decision-making process. Understand the technical and social/political limitations of EIA.	1	2												1	1
2	Understand the Environmental Act of India.	1	1											1		1
3	Understand the Screening process, scoping process and how we applied in the different projects.		2												2	
4	Assess and Predict Impacts on Attributes and have knowledge **of** EIA Report (Environmental Impact Statement, or Environmental Statement)		1											1		

Course Title: PAVEMENT ANALYSIS AND DESIGN			
Course Code: P18CV824	**Semester: VIII**	**L-T-P-H -2-2-0-4**	**Credits : 03**
Contact Period: Lecture: 52 Hrs	**Exam Hours :03 Hrs**	**Weight age: CIE:50; SEE:50**	
Prerequisites : Transportation Engineering			

Course Learning Objectives (CLOs)

The main objective of this course is to,

1. Gain knowledge of science and engineering to acquire the fundamentals of various factors affecting design and performance of pavements.
2. Calculate the stresses and deflection in flexible pavements.
3. Calculate the stresses and deflection in rigid pavements.
4. Design of flexible pavements by IRC method.
5. Design of rigid pavements by IRC method.

Course Content

UNIT – I

INTRODUCTION: Factors Affecting Pavement Design, Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types, Tire Pressure, Contact Pressure, EAL and ESWL Concept, Lane Distributions & Vehicle Damage Factors.

10 Hrs

Self study component:-Effect of Transient & Moving Loads.

UNIT – II

STRESSES AND DEFLECTIONS IN FLEXIBLE PAVEMENTS: Stresses and deflections in homogenous masses. Burmister's two-layer theory, three layer and multilayer theories, Problems on above.

10 Hrs

Self study component:-Application of two layer theory in flexible pavement design.

UNIT – III

FLEXIBLE PAVEMENT DESIGN: Design Methods Principle, Empirical, semi- empirical and theoretical design approaches, design steps, advantages and applications of different pavement design methods – CBR, McLeod, IRC.

10Hrs

Self study component:-Asphalt Institute method of pavement design

UNIT – IV

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.

10 Hrs

Self study component:-Westergaard's analysis of rigid pavements

UNIT – V

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. Problems on above. White topping, Sustainability concepts in pavement design.

12Hrs

Self study component:-Design of continuously reinforced concrete pavements.

TEXT BOOK:

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.

REFERENCE BOOKS:

1. Relevant IRC codes
2. Principles of Transportation Engineering- Partha Chakra Borthy, Prentice- Hall.
3. Specifications for Roads and Bridges- MoRT& H, IRC, New Delhi
4. HRB/TRB/IRC/International Conference on Structural Design of Asphalt Pavements.

Note: Self study for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of science and engineering to acquire the fundamentals of various factors affecting design and performance of pavements.
2. Calculate the stresses and deflection in flexible pavements.
3. Calculate the stresses and deflection in rigid pavements.
4. Design flexible and rigid pavements.

Course Articulation Matrix(CAM)																
Sl. No	**Course Outcome**	**Program outcome**												**Program Specific Outcomes**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
01	Apply the knowledge of science and engineering to acquire the fundamentals of various factors affecting design and performance of pavements.	3	1											3		
02	Calculate the stresses and deflection in flexible pavements.	2	2											1	2	
03	Calculate the stresses and deflection in rigid pavements.	2	2											1	2	
04	Design flexible and rigid pavements.		2	1											3	1

Course Title:Internship		
Course Code: P18CV83	**Semester: VIII**	**Credits :02**
Exam Hours :03 Hr	**Weight age: CIE:50; SEE:50**	

Guidelines for Internship:

I. Internship is of minimum eight weeks duration and to be completed between the vacation period of VI & VII semester and VII & VIII semester.

II. The internship can be carried out in any industry/ R & D Organization/ Research/ Institute/ Educational institute of repute/ Internshala (ACITE MoU Internship).

III. The Department/college shall nominate staff member/s to facilitate, guide and supervise students under internship.

IV. The Internal Guide has to visit place of internship at least once during the student's internship.

V. The students shall report the progress of the internship to the guide in regular intervals and seek his/her advice.

VI. After the completion of Internship, students shall submit a report with completion and attendance certificates to the Head of the Department with the approval of both internal and external guides.

VII. There will be 50 marks CIE (Seminar: 25, Internship report: 25) and 50 marks for Viva Voce conducted during Semester End Examination (SEE) of VIII Semester. For the conduction of Internship Semester End Examination following instructions are issued:

a. The Semester End Examination (SEE) for 50 marks shall be conducted similar to final semester project work / lab examination.
b. Internal & External Examiners shall be appointed by the BoE – Chairperson in consultation with HoD and approval of the same by the Principal & Controller of Examination.
c. External Examiner may be from the Industry. If the external examiner from the industry is not available, alternative arrangement shall be made by the BoE - Chairperson by appointing a faculty from out of the available faculty in the department, wherein the student is studying.

VIII. The students are permitted to carry out the internship anywhere in India or abroad. The Institution will not provide any kind of financial assistance to any student for carrying out the Internship.

IX. Failing to undergo Internship: Internship is one of the head for obtaining degree, therefore completion of internship is mandatory.

Course Title: Project Work Phase – II		
Course Code: P18CV84	**Semester: VIII**	**Credits :06**
Weight age: CIE:100 SEE:100		

Project Work: The Project Work (Phase I + Phase II) carries 8 credits (2 credits+6 credits) and spreads over TWO semesters, i.e. during 7th and 8th semesters.

I. Project Phase – I and Project seminar Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and seminar presentation skill.

II. The Assessment marks (CIE) in the case of Project Work - Phase I, shall be based on the evaluation at the end of the 7th semester by a committee consisting of Head of the concerned department, two senior faculty members of the department, one of them may be the internal guide. The work may be evaluated by the committee for award of Assessment marks (CIE) based on a Report [comprising of synopsis, Introduction, Literature survey, Objective and Methodology], presentation and viva voce.

III. The project work shall be carried out by candidate(s) independently/in a group (maximum of four) during the seventh and eighth semester under the guidance of one of the faculty members of the Department of study. If the project work is of inter-disciplinary nature, a co-guide shall be taken from the same or any other relevant Department. If a project work has to be carried out in any industry / factory / organization, outside the campus, the permission for the same and the name of co-guide at any of these organizations shall be intimated to the authorities at the beginning of seventh semester by the Head of the Department.

IV. The weekly progress of the Project work shall be monitored and reviewed by the Project Guide assigned by DUGC. The method of evaluation, including intermediate assessment shall be evolved by the pertinent DUGC.

V. A candidate shall submit N+3 (No. of candidates+3) copies of the Report of the Project Work to Head, DUGC on or before the specified date. The report shall be in the format prescribed by the Institute. The candidate shall submit a report of the project work (dissertation) duly approved by the guide and co-guide. The project report shall be countersigned by the guide, co-guide (if any) and the Head of the Department

VI. The last date for the submission of Report shall be Two weeks before the closure of the semester in which the project work credits have been registered for and is expected to be completed or as announced by the COE. The date of submission of the dissertation may be extended up to a maximum of eight academic years, from the date of commencement of the first semester in which the candidate has taken admission to the course.

VII. The final evaluation (CIE & SEE) for Project Work - Phase II is done by a Project Work Evaluation Committee (PWEC) constituted by the pertinent DUGC. There shall be an open seminar followed by a viva – voce examination as part of the final evaluation. After the final evaluation, appropriate letter grade is awarded.

VIII. If in the opinion of the PWEC, the Project Report is acceptable with minor modifications for the minimum passing grade 'E'(Fair) in the case of project, the PWEC shall value and instruct the candidate suitably to incorporate the necessary modifications and to resubmit it to the Chairman, PWEC. After such resubmission, the Chairman, PWEC will certify that the necessary modification has been incorporated.

IX. The Assessment marks in case of Project Work - Phase II and seminar shall be based on the evaluation, as per the guidelines, at the end of the 8th semester by a committee consisting of Head of the concerned department, two senior faculty members of the department (one of them may be the internal guide).

X. The Assessment marks sheet shall bear the signature of all those concerned, along with the date and seal of the Principal.

Course Title:Self-Study Course & Seminar			
Course Code: P18CV85	**Semester: VIII**	**L:T:P:H: 0:0:4:4**	**Credits :02**
Weight age: CIE: 50			

In the Self-Study course & Seminar, the student has to choose & study the courses related to the program discipline with her/his own efforts under the guidance of a Course Instructor/Project guide, using study materials available in open sources i.e. Massive Open Online Course (MOOC) NPTEL Courses. The intention of the course is to encourage the habit of self-learning.

Further, in addition to the above, the department has to release the pool of courses from the list of available 8 weeks NPTEL online courses. The student has to register for the course from the available pool during VII / VIII Semester and the same will be reflected in the Grade Card of the VIII Semester. The 50 marks CIE assessment is based on the final NPTEL score (i.e. Online assignments: 25% + Proctored exam: 75%). The NPTEL score will be mapped directly to the CIE marks as per the calculation below only if he /she has completed the NPTEL course (i.e. Certification).

CIE = (NPTEL Score X 1.5) / 2 = [Maximum CIE should be 50 Marks]

[Ex. – 1: If NPTEL Score is 60 then the CIE will be = (60 X 1.5)/2 = 45

Ex. – 2: If NPTEL Score is 80 then the CIE will be = (80 X 1.5)/2 = 50 (Max. CIE should be 50 Marks)]

If the student fails to complete the NPTEL course at the end of the VIII Semester, then the department has to constitute a committee consisting of the Head of the department, two senior faculty members of the department, one of them may be the internal guide. The evaluation is based on a Report, Presentation, and Viva-Voce and the assessment is a relative evaluation in context to the student completed NPTEL course Certification (i.e. the CIE Score should be less than the score of the student cleared NPTEL Course).