| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE301 | DESIGN OF CONCRETE STRUCTURES I | 3-1-0-4 | 2016 |

**Pre-requisites: CE202 Structural Analysis I**

**Course objectives**:

- To provide the students with the knowledge of the behavior of reinforced concrete structural elements in flexure, shear, compression and torsion
- To enable them to design essential elements such as beams, columns, slabs staircases and footings under various loads.

**Syllabus**:

Introduction- Limit State method of design- Analysis of singly reinforced rectangular beams- shear strength of RC beam-design of shear reinforcement-bond and development length- curtailment of reinforcement-design of singly reinforced beams-analysis and design of doubly reinforced beams – simply supported , cantilever- analysis of singly reinforced T-beams -design for torsion-design of one-way slab- cantilever slab- continuous slab (detailing only)- two way slabs- design using code coefficients- Limit State of Serviceability-deflection-cracking -Stair cases- design & detailing- Columns-effective length-design of axially loaded short columns with rectangular ties and helical reinforcement.

**Expected Outcomes:**

The students will be able to

i. Apply the fundamental concepts of limit state method
ii. Use IS code of practice for the design of concrete elements
iii. Understand the structural behavior of reinforced concrete elements in bending, shear, compression and torsion.
iv. Design beams, slab, stairs, columns and draw the reinforcement details.
v. Analyze and design for deflection and crack control of reinforced concrete members.

**Text Books / References:**


1. Pillai S.U & Menon D – Reinforced Concrete Design, Tata McGraw Hill Publishing Co ., 2005
2. Punmia, B. C, Jain A.K and, Jain A.K ,RCC Designs, Laxmi Publications Ltd., 10e, 2015
3. Varghese P.C, Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt Ltd,, 2008
4. Relevant IS codes ( I.S 456, I.S 875, SP 34 )


**COURSE PLAN**

| Module | Contents | Hours | Sem. Exam Marks % |
|---|---|---|---|
| I | Introduction- Plain and Reinforced concrete- Properties of concrete and reinforcing steel-Objectives of design-Different design philosophies- Working Stress and Limit State methods-Limit State | 9 | 15 |

| | | | |
|---|---|---|---|
| | method of design-Introduction to BIS code- Types of limit states-characteristic and design values-partial safety factors-types of loads and their factors.<br>Limit State of Collapse in Bending-assumptions-stress-strain relationship of steel and concrete- analysis of singly reinforced rectangular beams-balanced-under reinforced-over reinforced sections-moment of resistance codal provisions | | |
| II | Limit state of collapse in shear and bond- shear stresses in beams-types of reinforcement-shear strength of RC beam-IS code recommendations for shear design-design of shear reinforcement-examples<br>Bond and development length - anchorage for reinforcement bars - code recommendations regarding curtailment of reinforcement | 9 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| III | Design of Singly Reinforced Beams- basic rules for design- design example of simply supported beam- design of cantilever beam-detailing Analysis and design of doubly reinforced beams – detailing, T-beams- terminology- analysis of T beams- examples - Design for torsion-IS code approach- examples. | 9 | 15 |
| IV | Design of slabs- introduction- one-way and two-way action of slabs - load distribution in a slab- IS recommendations for design of slabs- design of one-way slab- cantilever slab- numerical problems – concepts of detailing of continuous slab –code coefficients. | 9 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| V | Two- way slabs- simply supported and restrained slabs – design using IS Code coefficients Reinforcement detailing<br>Limit State of Serviceability- limit state of deflection- short term and long term deflection-IS code recommendations- limit state of cracking- estimation of crack width- simple numerical examples | 10 | 20 |
| VI | Stair cases- Types-proportioning-loads- distribution of loads – codal provisions - design and detailing of dog legged stair- Concepts of tread-riser type stairs (detailing only)<br>Columns- introduction –classification- effective length- short column - long column - reinforcement-IS specifications regarding columns- limit state of collapse: compression -design of axially loaded short columns-design examples with rectangular ties and helical reinforcement | 10 | 20 |
| **END SEMESTER EXAMINATION** | | | |

Note

1. All designs shall be done as per current IS specifications
2. Special importance shall be given to detailing in designs
3. During tutorial hours detailing practice shall be done.
4. SI units shall be followed.
5. IS 456-2000 shall be permitted for the End Semester Examination

**QUESTION PAPER PATTERN (End semester exam)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** : 1. Each part should have at least one question from each module

2. Each question can have a maximum of 4 subdivisions (a, b, c, d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE303 | STRUCTURAL ANALYSIS -11 | 3-0-0-3 | 2016 |

**Pre-requisite: CE201 Mechanics of Solids**

**Course objectives**:

- To equip the students with the force and displacement methods of structural analysis with emphasis on analysis of rigid frames and trusses

**Syllabus** :

Slope Deflection Method, Moment Distribution Method, Clapeyrons Theorem (Three Moment Equation) , Kani's method of analysis, Beams curved in Plan, Plastic Theory

**Expected Outcomes:**

The students will be able to

i. analyse structures using force method
ii. analyse structures using displacement method
iii. analyse curved beams in plan
iv. analyse structures using plastic theory

**Text Books :**


1. Kenneth Leet, Chia M Uang & Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill, 4e, 2010
2. R. Vaidyanathan and P. Perumal, Structural Analysis Volume I & II, Laxmi Publications (P) Ltd., 2017
3. Reddy . C.S., Basic Structural Analysis, Tata McGraw Hill, 3e, 2011


**References:**


1. Daniel L Schodak, Structures, Pearson Education, 7e, 2014
2. Hibbeler, RC, Structural analysis, Pearson Education, 2012
3. Kinney J. S., Indeterminate Structural Analysis, Oxford & IBH, 1966
4. Negi L. S. and Jangid R. S, Structural Analysis, Tata McGraw Hill, 1997
5. Rajasekaran S. and Sankarasubramanian G., Computational Structural Mechanics, PHI, 2008
6. S.S. Bhavikatti, Structural Analysis II, Vikas Publication Houses (P) Ltd, 2016
7. SP:6 (6): Application of Plastic Theory in Design of Steel Structures, Bureau of Indian Standards, 1972
8. Timoshenko S. P. and Young D. H., Theory of Structures, McGraw Hill, 2e, 1965
9. Utku S, Norris C. H & Wilbur J. B, Elementary Structural Analysis, McGraw Hill, 1990
10. Wang C. K., Intermediate Structural Analysis, Tata McGraw Hill, 1989


**COURSE PLAN**

| Module | Contents | Hours | Sem. Exam Marks % |
|---|---|---|---|
| I | **Clapeyrons Theorem (Three Moment Equation) :**Derivation of three | 7 | 15 |

| | | | |
|---|---|---|---|
| | moment equation - application of three moment equation for analysis of continuous beams under the effect of applied loads and uneven support settlement. | | |
| II | **Slope Deflection Method : A**nalysis of continuous beams- beams with overhang- analysis of rigid frames - frames without sway and with sway - different types of loads -settlement effects | 7 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| III | **Moment Distribution Method:** Moment Distribution method – analysis of beams and frames – non sway and sway analysis . | 7 | 15 |
| IV | **Kani's Method:** Kani's Method of analysis applied to continuous beams and single bay single storey rigid frames rigid frames – frames without sway and with sway. | 6 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| V | **Beams curved in plan**: Analysis of cantilever beam curved in plan, analysis of circular beams over simple supports. | 7 | 20 |
| VI | **Plastic Theory:** Introduction – plastic hinge concepts – plastic modulus – shape factor – redistribution of moments – collapse mechanisms – Plastic analysis of beams and portal frames by equilibrium and mechanism methods.(Single Storey and Single bay Frames only) | 8 | 20 |
| **END SEMESTER EXAMINATION** | | | |

**QUESTION PAPER PATTERN (End semester exam)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** :

1. Each part should have at least one question from each module.
2. Each question can have a maximum of 4 subdivisions (a, b, c, d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE305 | GEOTECHNICAL ENGINEERING - II | 3-0-0-3 | 2016 |

**Pre-requisite** CE208 Geotechnical Engineering - I

**Course objectives**:

- To impart to the students, in-depth knowledge about the basic concepts and theories of foundation engineering;
- To enable the students to acquire proper knowledge about various methods of foundation analysis for different practical situations.

**Syllabus**:

Stresses in subsoil due to loaded areas of various shapes, Boussinesq's formula, Newmark's chart, Lateral earth pressure, Rankine's and Coulomb' theories, Influence of surcharge, inclined backfill, water table and layering, Terzaghi's bearing capacity theory for isolated footings, Local and general shear failure, Total and differential settlements, soil improvement techniques, combined footings, raft foundations, well foundation, Problems encountered in well sinking, Pile foundations, Bearing capacity of single pile static and dynamic formulae, Capacity of Pile groups, Machine foundation, Methods of vibration isolation, site investigation, Guidelines for choosing spacing and depth of borings, boring methods, Standard Penetration Test.

**Expected Outcomes:**

The students will be able to understand

i. the basic concepts, theories and methods of analysis in foundation engineering;
ii. the field problems related to geotechnical engineering and to take appropriate engineering decisions.

**Text Books :**


1. Braja M. Das, "Principles of Foundation Engineering", Cengage Learning India Pvt. Ltd., Delhi, 2011.
2. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers, 2011
3. Murthy V N S., "Advanced Foundation Engineering", CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2007


**References:**


1. Alam Singh., "Soil Engineering in Theory and Practice", Vol.1, CBS Publishers & Distributors Pvt. Ltd., New Delhi. 2002
2. Gopal Ranjan and and Rao A.S.R., " Basic and Applied Soil Mechanics", New Age International (P) Limited, New Delhi, 2002.
3. Purushothamaraj P., Soil Mechanics and Foundation Engineering, Dorling Kindersley(India) Pvt. Ltd., 2013
4. TengW.E., "Foundation Design", Prentice Hall , New Jersey, 1962.
5. Venkataramiah, "Geotechnical Engineering", Universities Press (India) Limited, Hyderabad, 2000.

| COURSE PLAN | | | |
|---|---|---|---|
| **Module** | **Contents** | **Hours** | **Sem. Exam Marks %** |
| **I** | Stresses in soil due to loaded areas - Boussinesq's formula for point loads – assumptions [no derivation required] – Comments - numerical problems<br>Vertical stress beneath loaded areas of strip, rectangular and circular shapes(no derivation required)- Newmark's chart[construction procedure not required] - Isobars- Pressure bulbs- numerical problems | 6 | 15 |
| **II** | Lateral earth pressure – At-rest, active and passive earth pressures – Practical examples<br>Rankine's and Coulomb' theories[no derivation required]-Influence of surcharge, inclined backfill and water table on earth pressure- numerical problems<br>Earth pressure on retaining walls with layered backfill- numerical problems | 6 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| **III** | Bearing capacity of shallow foundations – Ultimate, safe and allowable bearing capacity. - Failure mechanism, assumptions and equation of Terzaghi's bearing capacity theory for strip footing[no derivation required] – Terzaghi's formulae for circular and square footings numerical problems<br>Local and general shear failure - Factors affecting bearing capacity – Influence of water table - numerical problems<br>Total and differential settlement- Causes - Methods of reducing differential settlement–Brief discussion on soil improvement through installation of drains and preloading. | 7 | 15 |
| **IV** | Combined footings- Rectangular and Trapezoidal combined footings - numerical problems<br>Raft foundations (Design Concepts only) - Allowable Bearing capacity of Rafts on sands and clays - Floating foundation.<br>Deep foundations - Elements of a well foundation – Problems encountered in well sinking – Methods to rectify tilts and shifts | 6 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| **V** | Pile foundations - Point bearing and friction piles - Bearing capacity of single pile in clay and sand[I.S. Static formulae] - numerical problems<br>Dynamic formulae(Modified Hiley formulae only) - I.S. Pile load test [conventional]- Negative skin friction - numerical problems<br>Group action - Group efficiency - Capacity of Pile groups- numerical problems | 8 | 20 |

| | | | |
|---|---|---|---|
| **VI** | Brief introduction to Machine foundation –Mass spring model for undamped free vibrations - Natural frequency – Coefficient of uniform elastic compression – Methods of vibration isolation<br>Brief introduction to site investigation –Objectives - Guidelines for choosing spacing and depth of borings [I.S. guidelines only] - Auger boring and wash boring methods - Standard Penetration Test – procedure, corrections and correlations. | 9 | 20 |
| **END SEMESTER EXAMINATION** | | | |



**QUESTION PAPER PATTERN (End semester exam)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE307 | GEOMATICS | 3-0-0-3 | 2016 |

**Prerequisite : CE207 Surveying**

**Course objectives**:

- To impart awareness on the advanced surveying techniques
- To understand the errors associated with survey measurements
- To provide a basic understanding on geospatial data acquisition and its process

**Syllabus**:

Traverse Survey, Curve Surveying, Global Navigation Satellite System, Global Positioning Systems, Remote Sensing, Geographical Information System

**Course Outcomes:**

- The students will possess knowledge on the advanced methods of surveying, the instruments and the spatial representation of data.

**Text Books / References:**


1. Dr. B.C. Punmia , Ashok Kumar Jain & Arun Kumar Jain - Surveying , Laxmi publications (P) Ltd , 2005
2. Prof. T.P. Kenetkar and Prof. S.V. Kulkarni - Surveying and Levelling, Pune Vidyarthi Griha Prakashan,2004
3. R.Agor - A Text book of Surveying and Levelling, Khanna Publishers, 2005
4. S.K. Duggal - Surveying Vol. II, Tata McGraw Hill Ltd ,Reprint 2015


**References :**


1. Burrough P , Principles of Geographical Information systems, Oxford University Press, 1998
2. Chang,K , "Introduction to Geographic Information Systems", Tata McGraw-Hill Publishing Co. Ltd, 2008
3. George Joseph, "Fundamentals of Remote Sensing", University Press, 2003
4. Iliffe, C.J., Datums and Map Projections for Remote Sensing, GIS and Surveying, Whittles Publishing, 2006
5. James M Andersen, Edward M Mikhail, Surveying Theory and Practice, McGraw Hill education, 7e, 1998
6. Kang-tsung Chang, 'Introduction to GIS' , Tata McGraw-Hill Publishing Co. Ltd, 8e, 2016
7. Lillesand M and Kiefer W, "Remote Sensing and Image Interpretation". John Wiley and Sons,Inc., 2000


**COURSE PLAN**

| Module | Contents | Hours | Sem. Exam Marks % |
|---|---|---|---|
| I | **Traverse Surveying** - Methods of traversing, Checks in closed traverse, Traverse computations, Balancing the traverse- methods | 6 | 15 |

| | | | |
|---|---|---|---|
| II | C**urve Surveying** – Elements of simple and compound curves – Method of setting out– Elements of Reverse curve (Introduction only)– Transition curve – length of curve – Elements of transition curve - Vertical curve (introduction only) | 8 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| III | **Global Navigation Satellite System-** Types**, Global Positioning Systems**-Components and Principles, Satellite ranging-calculating position, Satellite signal structure, code phase and carrier phase measurements, GPS errors and biases, Application of GPS | 6 | 15 |
| IV | **GPS Surveying methods**-Static, Rapid static , Kinematic methods – DGPS, Phases of GPS Survey -Planning and preparation, Field operation-horizontal and vertical control, data sheet, visibility diagram, Processing and report preparation, | 6 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| V | **Remote Sensing** : Definition- Electromagnetic spectrum-Energy interactions with atmosphere and earth surface features-spectral reflectance of vegetation, soil and water- Classification of sensors-Active and Passive, Resolution-spatial, spectral radiometric and Temporal resolution, Multi spectral scanning-Along track and across track scanning | 8 | 20 |
| VI | **Geographical Information System**-components of GIS, GIS operations, Map projections- methods, Coordinate systems-Geographic and Projected coordinate systems, Data Types- Spatial and attribute data, Raster and vector data representation-Data Input methods-Geometric Transformation-RMS error, Vector data Analysis-buffering, overlay. | 8 | 20 |
| **END SEMESTER EXAMINATION** | | | |

**QUESTION PAPER PATTERN (End semester exam)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE309 | WATER RESOURCES ENGINEERING | 3-0-0-3 | 2016 |

**Pre-requisite : NIL**

**Course objectives**

- To impart knowledge regarding the availability of water on hydrosphere, its distribution and quantification
- To convey the knowledge on the scientific methods for computing irrigation water requirements
- To communicate fundamental knowledge on reservoir engineering and river engineering

**Syllabus**

Hydrologic cycle, Precipitation, Infiltration and Evaporation-measurement and data analysis. Runoff-components and computation, Hydrograph, Unit Hydrograph and S-Hydrograph. Irrigation types and methods-Soil water plant relationships, Frequency of irrigation, Computation of crop water requirement. Stream flow measurement -Stage-discharge curve. Meandering of rivers, river training works. Surface water systems: diversion and storage systems, reservoir - estimation of storage capacity and yield of reservoirs - reservoir sedimentation -useful life of reservoir. Groundwater - Aquifer types and properties - Steady radial flow into a well. Estimation of yield of an open well.

**Expected Outcome**

After successful completion of this course, the students will be able to :

i. Describe the hydrologic cycle and estimate the different components
ii. Determine crop water requirements for design of irrigation systems
iii. Compute the yield of aquifers and wells.
iv. Know the features of various river training works
v. Estimate the storage capacity of reservoirs and their useful life.

**Text Books:**


1. Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, New Delhi, 2009.
2. Garg S.K, Irrigation Engineering and Hydraulic Structures Khanna Publishers New Delhi 2006.
3. Modi. P. N. Irrigation, Water Resources and Water Power Engineering, S.B.H Publishers and Distributors New Delhi 2009.
4. Punmia B.C. Ashok K Jain, Arun K Jain, B. B. L Pande, Irrigation and Water Power Engineering, Laxmi Publications (P) Ltd. 2010.


**References:**


1. Asawa. G.L. Irrigation and Water Resources Engineering, New Age International, 2000
2. Ojha.C.S.P., R.Berndtsson, P. Bhunya, Engineering Hydrology, Oxford university Press, 2015.
3. Patra. K.C., Hydrology and Water Resources Engineering, CRC Press, 2010.
4. Sahasrabudhe S.R., Irrigation Engineering & Hydraulic Structures, S.K. Kataria & Sons, 2013.
5. Subramanya. K., Engineering Hydrology, Tata Mc Graw Hill, 2011
6. Todd D. K., Ground Water Hydrology, Wiley, 2005.
7. Ven Te Chow, David R Maidment, L.W Mays., Applied Hydrology, McGraw Hill, 1988
8. Warren Viessman, G.L. Lewis, Introduction to Hydrology, Pearson Education, 2003.

| COURSE PLAN | | | |
|---|---|---|---|
| **Module** | **Contents** | **Hours** | **Sem. Exam Marks %** |
| **I** | Hydrologic cycle-precipitation-mechanism, types and forms. Measurement of rainfall using rain gauges-optimum number of rain gauges. Estimation of missing precipitation. Representation of rainfall data-mass curve and hyetograph. Computation of mean precipitation over a catchment. Design rainfall - probable maximum rainfall. Infiltration-measurement by double ring infiltrometer. Horton's model. Evaporation-measurement by IMD land pan, control of evaporation. | 8 | 15 |
| **II** | Runoff-components of runoff-methods of estimation of runoff-infiltration indices, Hydrograph analysis-Hydrograph from isolated storm-Base flow separation. Unit hydrograph –uses. Assumptions and limitations of unit hydrograph theory. Computation of storm/flood hydrograph of different duration by method of superposition and by development of S– Hydrograph. | 8 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| **III** | Irrigation– Necessity, Benefits and ill effects. Types: flow and lift irrigation - perennial and inundation irrigation. Methods: flooding, furrow, sprinkler and drip irrigation (concepts only, no design aspects/problems), Soil water plant relationships, soil moisture constants, Computation of crop water requirement: depth and frequency of Irrigation, Duty and delta, relationship, variation of duty, factors. Computation of design discharge of conveyance channels, Irrigation efficiencies. Consumptive use of water: concept of Evapotranspiration. (No detailed discussion on estimation procedures) | 6 | 15 |
| **IV** | Stream flow measurement: methods, Estimation of stream flow by area velocity method only, Stage discharge curve. Meandering of rivers, River training – objectives and classification, description of river training works. | 6 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| **V** | Surface Water system: diversion and storage systems, necessity. River flow: Flow duration Curve, Firm yield. Reservoirs-types of reservoirs, zones of storage reservoir, reservoir planning-storage capacity and yield of reservoirs-analytical method and mass curve method. Reservoir sedimentation: trap efficiency, methods for control. Computation of useful life of reservoir. | 7 | 20 |
| **VI** | Ground water : vertical distribution of groundwater, classification of saturated formation, water table, Aquifer properties : Porosity, Specific yield, specific retention, Types of aquifers. Darcy's law, co-efficient of permeability, Transmissibility. Wells- Steady radial flow into a fully penetrating well in Confined and Unconfined aquifers. Estimation of yield of an open well, pumping and recuperation tests. Tube wells – types. | 7 | 20 |
| **END SEMESTER EXAMINATION** | | | |

**QUESTION PAPER PATTERN (End semester exam)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** : 1.Each part should have at least one question from each module

2 Each question can have a maximum of 4 subdivisions (a, b, c, d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE365 | FUNCTIONAL DESIGN OF BUILDINGS | 3-0-0-3 | 2016 |

**Prerequisite : CE204 Construction Technology**

**Course objectives**:

- To understand the acoustical design concepts and noise control techniques
- To impart the fundamental concepts of natural and artificial lighting designs
- To provide principles of climatic conscious design of buildings with special emphasis on tropical climates.
- To understand the apparent position of sun with respect to earth during different periods of the year and apply it in computation of solar radiation and design of shading devices.

**Syllabus**:

Acoustics : Physics of sound- Behavior of sound- Sound insulation and reverberation control
Lighting: Principles- Day lighting and artificial lighting – design methods
Thermal design of buildings: Climatic elements – classification- thermal comfort and indices-solar radiation calculations and design of shading devices.
Thermo physical properties of building materials and thermal control- passive and active building design- Steady and periodic heat flow through building envelope. Concept of green building.

**Expected Outcomes:**

On completion of the course, the students will be able to:

i. Analyze and make effective decisions in use of principles of functional planning of the buildings with respect to Acoustics and Lighting and Thermal design of buildings in various climatic zones that the student may encounter in his/her professional career.
ii. Select different building materials and explain the manner in which they can be used in different types of buildings with respect to various functional requirements like acoustics, lighting and thermal comfort.
iii. Apply the techniques learned to the estimate solar radiation falling on different surfaces of the buildings, design shading devices to protect from direct sunlight, design of energy efficient, functionally comfortable buildings, low energy buildings and green buildings.

**References :**


1. Ajitha Simha.D, Building Environment, Tata McGraw Hill Publishing Co., New Delhi, 1985
2. Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987
3. Givoni. B Man,. Climate and Architecture, Applied Science Publication, 1976
4. Knudsen V.O. and Harris C.M., Acoustical Design in Architecture, John Wiley, 1980
5. Koenigseberger, Manual of tropical Housing and Building Part I – Climatic design, Orient Longman, 2011
6. Krishnan, Climate responsive architecture, Tata McGraw Hill, 1999
7. M David Egan , Architectural Acoustics, J.Ross Publishing, 2007
8. Olgay Victor, Design with climate-A bioclimatic approach to architectural regionalism- Princeton University press-1963

| COURSE PLAN | | | |
|---|---|---|---|
| **Module** | **Contents** | **Hours** | **Sem. Exam Marks %** |
| I | **Acoustics, fundamentals:** Physics of sound-Frequency, period amplitude. Intensity of sound- Watts/$m^2$- Bel- Decibel scales- dBA-Phon. Addition of sound levels. Human Audibility range. Behavior of sound in free and reverberant fields. Noise- allowable limits-effect of noise on human-Air and structure born noises-equivalent noise levels-day and night equivalent. | 7 | 15 |
| II | **Acoustics, applications:** Measures of noise control- Source-path and receiving end. TL value and computation of TL value, Flanking paths. Sound absorption-materials and fixings. Reverberation-Sabines formula-Eyrings modification. Acoustical defects- acoustical design of auditoriums and small lecture halls. Acoustical considerations of offices, hospitals and Industrial buildings. | 7 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| III | **Lighting, Natural:** Visual tasks – Natural lighting- illumination requirements for various buildings –principles of day lighting – day light factor and its components- Design of side-lit windows-BIS and CBRI methods-skylights | 6 | 15 |
| IV | **Lighting, Artificial**: Artificial lighting- illumination requirements-lux meter – lamps and luminaries – polar distribution curves– Colour temperature and colour rendering index- glare -Design of artificial lighting – lumen method – point by point method. Basic idea of street lighting and outside lighting | 6 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| V | **Thermal comfort:** Factors affecting thermal comfort<br>Effective temperature –Thermal comfort indices-ET-CET Charts-Bioclimatic chart- Psychrometry and Psycrometric chart.<br>**Earth-Sun relationship**: Sun's apparent movement with respect to the earth. Solar angles-Computation of solar radiation on different surfaces-solar path diagram-shadow-throw concept and design of shading devices | 8 | 20 |
| VI | **Heat flow through building envelope**: Thermo physical properties of building materials: Thermal quantities – heat flow – thermal conductivity – resistance and transmittance and surface coefficient - Sol- air temperature concept- solar gain factor. Thermal transmittance of structural elements – thermal gradients – heat gain/loss calculation. Periodic heat flow – time lag and decrement factor.<br>**Design approaches**: Climate conscious designs- Climatic zones in India- orientation and shape of buildings in different climatic zones-Passive solar-Active solar and Active approaches. Requirements of buildings in tropical areas-Thermal insulation-Introduction to the concept of green-building | 8 | 20 |
| **END SEMESTER EXAMINATION** | | | |

**QUESTION PAPER PATTERN (End semester examination)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** : 1.Each part should have at least one question from each module

2 Each question can have a maximum of 4 subdivisions (a,b,c,d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE371 | **Environment and Pollution** | 3-0-0-3 | 2016 |

**Prerequisites: Nil**

**Course objectives**:

- To understand the various types of environmental and industrial pollution, pollutants, related diseases and their causes
- To impart the various management techniques available for pollution abatement

**Syllabus**

Pollution, Environmental and industrial, Types. Air pollution-sources, effects, types of pollutants. Water pollution, characteristics of water pollutants, water borne diseases, water quality standards. Solid wastes, sources, types, control methods, soil pollution, urbanization, land degradation, pesticide pollution. Noise pollution, sources, effects, control measures, industrial pollution, occupational health hazards, industrial hygiene

**Expected Outcomes:**

i. To have a basic knowledge of various pollution sources and their effects
ii. To have an awareness of the various methods of prevention and reduction of pollutant

**Text Books / References:**


1. B.C.Bhartia, Environmental Pollution and Control in Chemical Process Industries, Khanna Publishers, Delhi, 2001.
2. Danny D Reible, Fundamentals of Environmental Engineering, CRC Press, 1998
3. Gilbert M Masters, Wendell P Ela, Introduction to Environmental Engineering and Science, Pearson Education, 2007
4. Howard S Peavy, Donald R Rowe, George Tchobanoglous, Environmental Engineering, McGrawHill Education , 1984
5. Kurian Joseph & R.Nagendran, Essentials of Environmental Studies, Pearson Education (Singapore) Pvt.Ltd, New Delhi, 2004.
6. N.N Basak, Environmental Engineering, McGrawHill Education, Reprint 2015
7. P.AarneVesiland, Introduction to Environmental Engineering, PWS publishing company Boston, 1997.
8. Suresh K Dhameja, Environmental Engineering and Management, S.K.Kataria& Sons, Delhi, 2010.


**COURSE PLAN**

| Module | Contents | Hours | Sem. Exam Marks % |
|---|---|---|---|
| I | Environment-Introduction-Multidisciplinary Nature<br>Components of Environment, Ecology, Ecosystem- Material Cycling-Carbon and Nitrogen cycles<br>Introduction: Classification of Pollution and Pollutants of environment, Pollution related Diseases, Basic requirements for healthy environment | 6 | 15 |

| | | | |
|---|---|---|---|
| II | Air Pollution: Primary and Secondary Pollutants, Industrial Pollution, Ambient Air Quality Standards, Types of air pollutants-sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter. Effects of air pollutants on human, vegetation and environment | 6 | 15 |
| **FIRST INTERNAL EXAMINATION** | | | |
| III | Water Pollution: Point and Non-point Source of Pollution, Major Pollutants of Water, Physical, chemical and biological characteristics of water , Water borne diseases, Water Quality standards | 7 | 15 |
| IV | Solid Waste: Classification of Solid Waste, Composition and Characteristics of Solid Waste, Plastic wastes; Segregation of Solid waste, recycling and reuse of solid wastes, E-waste: Sources of generation,. | 7 | 15 |
| **SECOND INTERNAL EXAMINATION** | | | |
| V | Land/Soil Pollution: Effects of urbanization on land degradation, Impact of Modern Agriculture on Soil, pesticide pollution, Effect on Environment and Life sustenance, Abatement measures | 8 | 20 |
| VI | Noise pollution: Sources of Noise, Effects of Noise, measurement of noise, Equivalent sound pressure level, Control measures | 8 | 20 |
| **END SEMESTER EXAMINATION** | | | |

**QUESTION PAPER PATTERN (End semester examination)**

**Maximum Marks :100** **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note** : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a,b,c,d)

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE331 | MATERIAL TESTING LAB -II | 0-0-3-1 | 2016 |

**Pre-requisite: CE204 Construction Technology**

**Course objectives**:

- To enable experimental evaluation of properties of the materials used for concrete
- To obtain the characteristics of the materials.

**List of Experiments:**

1. Determination of the Specific Gravity and Soundness of cement
2. Determination of the Standard Consistency, Initial and Final Setting Times of Cement and the compressive strength of Cement.
3. Tests on fine aggregate – specific gravity, bulking, sieve analysis, fineness modules, moisture content , bulk density
4. Tests on coarse aggregate - specific gravity, sieve analysis, fineness modulus, bulk density.
5. Tests on Fresh Concrete: Workability : Slump, Vee-Bee, Compaction factor tests ,flow test
6. Determination of the Compressive Strength of Concrete by Cube and Cylinder.
7. Carrying out the Split Tensile and Flexural strength of Concrete.
8. Compressive strength of Brick as per IS
9. Transverse strength of tiles
10. Demonstration of Mix Design of Concrete by IS methods
11. Non destructive tests (rebound hammer & ultrasonic pulse velocity)

**Books/Manuals /References:-**


1. Concrete Lab Manual, TTTI Chandigarh
2. M.L. Gambhir, Concrete Manual, Dhanpat Rai & Sons, Delhi.
3. M.S.Shetty , Concrete Technology, Theory and Practice , S.Chand& Company, 2014
4. Relevant latest IS codes on Aggregates, Cement & Concrete [269, 383, 2386, 10262(2009), SP23]

| Course Code | Course Name | L-T-P-Credits | Year of Introduction |
|---|---|---|---|
| CE333 | GEOTECHNICAL ENGINEERING LAB | 0-0-3-1 | 2016 |

**Pre-requisite : CE208 Geotechnical Engineering - I**

**Course objectives**:

- To understand the laboratory tests used for determination of physical, index and Engineering properties of soil.

**List of Experiments:**

1. Determination of Water Content, Specific Gravity and Shrinkage Limit
2. Field Density determination and Sieve Analysis
3. Atterberg Limits (Liquid Limit and Plastic Limit)
4. Hydrometer Analysis
5. Direct Shear test
6. Standard Proctor Compaction Test
7. Permeability Test and Unconfined Compression Test
8. Consolidation Test
9. Swelling Test
10. Heavy compaction
11. California Bearing Ratio Test.

**Expected Outcomes:**

The students will

i. have thorough knowledge about the procedures of laboratory tests used for determination of physical, index and engineering properties of soils
ii. have the capability to classify soils based on test results and interpret engineering behavior based on test results
iii. be able to evaluate the permeability and shear strength of soils
iv. be able to evaluate settlement characteristics of soils
v. be able to evaluate compaction characteristics required for field application

**Text Books / References:**


1. IS codes relevant to each test
2. C. Venkatramaiah, Geotechnical Engineering, New Age International publishers, 2012
3. Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International Publishers, 2012
4. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers, 2011