NAGARJUNA

COLLEGE OF ENGINEERING & TECHNOLOGY

*An Autonomous College under VTU*

# *DEPARTMENT OF CIVIL ENGINEERING*

## VISION

To transform the students as leaders in Civil Engineering to achieve professional excellence in the challenging future.

## MISSION

**M1:** To provide the Civil Engineering knowledge and skills for students through an excellent academic environment.

**M2:** Adopting innovative teaching techniques using modern engineering tools for designing,modeling and analyzing the societal and environmental problems.

**M3:** Developing Communication skill, leadership qualities through team work and skills for continuing education among the students.

**M4:** To inculcate moral, ethical and professional values among students to serve the society.

**M5:** Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

## III to VIII Semesters

**Outcome Based Education and Choice Based Credit System**

***Scheme and Syllabus***

***With effect from Academic Year 2015 -16***

# Third Semester B.E. - Scheme

| Sl. No | Course Code | Course | Teaching Dept. | L-T-P-S (Hrs/week) | Total Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | 15CVM31 | Engineering Mathematics-III (IC) | Mathematics | 3-0-2-0 | 4 | 100 |
| 2 | 15CVT32 | Building Materials and Concrete Technology | CE | 3-0-0-0 | 3 | 100 |
| 3 | 15CVT33 | Strength of Materials | CE | 3-0-0-0 | 3 | 100 |
| 4 | 15CVT34 | Surveying | CE | 4-0-0-0 | 4 | 100 |
| 5 | 15CVI35 | Engineering Geology (IC) | CE | 3-0-2-0 | 4 | 100 |
| 6 | 15CVT36X | Foundation Elective-I | CE | 3-0-0-0 | 3 | 100 |
| 7 | 15CVL37 | Basic Material Testing Laboratory | CE | 1-0-2-0 | 2 | 100 |
| 8 | 15CVL38 | Surveying Practice-I | CE | 1-0-2-0 | 2 | 100 |
| 9 | 15CVH39 | Soft Skills Development | CE | 0-2-0-0 | 1 | 100 |
| Total | | | | 21-2-8-0 | 26 | 900 |

# Foundation Elective-I

| Sl. No | Course Code | Course |
|---|---|---|
| 1 | 15CVT361 | Ecology and Environmental Impact Assessment |
| 2 | 15CVT362 | Rural Water Supply and Sanitation |
| 3 | 15CVT363 | Solid Waste Management |

# Fourth Semester B.E. - Scheme

| Sl. No | Course Code | Course | Teaching Dept. | L-T-P-S (Hrs/week) | Total Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | 15CVM41 | Engineering Mathematics-IV (IC) | Mathematics | 3-0-2-0 | 4 | 100 |
| 2 | 15CVT42 | Fluid Mechanics | CE | 4-0-0-0 | 4 | 100 |
| 3 | 15CVT43 | Structural Analysis-I | CE | 3-0-0-0 | 3 | 100 |
| 4 | 15CVI44 | Building Planning and Drawing (IC) | CE | 3-0-2-0 | 4 | 100 |
| 5 | 15CVT45X | Foundation Elective-II | CE | 3-0-0-0 | 3 | 100 |
| 6 | 15CVT46X | Engineering Elective-III | CE | 3-0-0-0 | 3 | 100 |
| 7 | 15CVL47 | Concrete Laboratory | CE | 1-0-2-0 | 2 | 100 |
| 8 | 15CVL48 | Surveying Practice-II | CE | 1-0-2-0 | 2 | 100 |
| 9 | 15CVH49 | Soft Skills Development | CE | 0-2-0-0 | 1 | 100 |
| Total | | | | 21-2-8-0 | 26 | 900 |

# Foundation Elective-II

| Sl. No | Course Code | Course |
|---|---|---|
| 1 | 15CVT451 | Air Pollution and Control |
| 2 | 15CVT452 | Remote Sensing and GIS |
| 3 | 15CVT453 | Alternative Building Materials |
| 4 | 15CVT454 | Advanced Concrete Technology |

# Engineering Elective-III

| Sl. No | Course Code | Course |
|---|---|---|
| 1 | 15CVT461 | Renewable Energy Resources |
| 2 | 15CVT462 | Object Oriented Programming with C++ |
| 3 | 15CVT463 | Management Information Systems |
| 4 | 15CVT464 | Smart Materials |

**IC – Integrated Course** **L – Lecture** **T-Tutorials**

**P-Practical** **S – Self Study**

# Fifth Semester B.E. – Scheme

| Sl. No. | Course Code | Course | Teaching Dept. | L-T-P-S (Hrs/week) | Total Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | 15CVI51 | Transportation Engineering (IC) | CV | 3-0-2-0 | 4 | 100 |
| 2 | 15CVT52 | Structural Analysis-II | CV | 3-0-0-0 | 3 | 100 |
| 3 | 15CVI53 | Design of RCC Structural Elements (IC) | CV | 3-0-2-0 | 4 | 100 |
| 4 | 15CVT54X | Foundation Elective-IV | CV | 3-0-0-0 | 3 | 100 |
| 5 | 15CVT55X | Foundation Elective-V | CV | 3-0-0-0 | 3 | 100 |
| 6 | 15CVT56X | Engineering Elective-VI / PBL | CV | 3-0-0-0 | 3 | 100 |
| 7 | 15CVL57 | Fluid Mechanics Lab | CV | 1-0-2-0 | 2 | 100 |
| 8 | 15CVL58 | Analysis and Design Lab-I | CV | 1-0-2-0 | 2 | 100 |
| 9 | 15CVH59 | General Aptitude | CV/BS&H | 2-0-0-0 | 2 | 100 |
| **Total** | | | | **22-0-8-0** | **26** | **900** |

## Foundation Elective – IV

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT541 | Construction Industry Practice-I |
| 2 | 15CVT542 | Advanced Fluid Mechanics |
| 3 | 15CVT543 | Traffic Engineering |

## Foundation Elective – V

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT551 | Advanced Surveying |
| 2 | 15CVT552 | Construction Management and Engineering Economics |
| 3 | 15CVT553 | Online Certification courses from IITs / IISc / SWAYAM / EDX |

## Engineering Elective – VI / PBL

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT561 | Green Buildings |
| 2 | 15CVT562 | Building Services |
| 3 | 15CVT563 | Hydrology and Irrigation Engineering |

# Sixth Semester B.E. – Scheme

| Sl. No. | Course Code | Course | Teaching Dept. | L-T-P-S (Hrs/week) | Total Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | 15CVI61 | Design of Steel Structures (IC) | CV | 3-0-2-0 | 4 | 100 |
| 2 | 15CVT62 | Geotechnical Engineering-I | CV | 3-0-0-0 | 3 | 100 |
| 3 | 15CVI63 | Environmental Engineering (IC) | CV | 3-0-2-0 | 4 | 100 |
| 4 | 15CVT64X | Foundation Elective-VII | CV | 3-0-0-0 | 3 | 100 |
| 5 | 15CVT65X | Engineering Elective-VIII / PBL | CV | 3-0-0-0 | 3 | 100 |
| 6 | 15HOE66X | Open Elective-IX | CV/BS&H | 2-0-0-4 | 3 | 100 |
| 7 | 15CVL67 | Detailing of Structural Elements Lab | CV | 1-0-2-0 | 2 | 100 |
| 8 | 15CVL68 | Extensive Survey Camp | CV | 1-0-2-0 | 2 | 100 |
| 9 | 15CVH69 | Technical Aptitude and GD | CV/BS&H | 2-0-0-0 | 2 | 100 |
| **Total** | | | | **21-0-8-4** | **26** | **900** |

## Foundation Elective – VII

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT641 | Construction Industry Practice-II |
| 2 | 15CVT642 | Advanced Transportation Engineering |
| 3 | 15CVT643 | Earthquake Resistant Design of Structures |

## Engineering Elective – VIII / PBL

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT651 | Pollution Control and Management |
| 2 | 15CVT652 | Water Resources Engineering |
| 3 | 15CVT653 | Pavement Materials and Construction |

## Open Elective – IX

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15HOE661 | Lab View – Level 1 |
| 2 | 15HOE662 | Yoga and Meditation |
| 3 | 15HOE663 | Martial Arts |
| 4 | 15HOE664 | Music (Carnatic Vocal / Instrumental) |
| 5 | 15HOE665 | Dance |
| 6 | 15HOE666 | Sports |
| 7 | 15HOE667 | Online Certification Courses from IITs / IISc / SWAYAM / EDX |

# Seventh Semester B.E. – Scheme

| Sl. No. | Course Code | Course | Teaching Dept. | L-T-P-S (Hrs/week) | Total Credits | Marks |
|---|---|---|---|---|---|---|
| 1 | 15CVT71 | Geotechnical Engineering-II (IC) | CV | 3-0-2-0 | 4 | 100 |
| 2 | 15CVT72 | Estimation and Valuation (IC) | CV | 3-0-2-0 | 4 | 100 |
| 3 | 15CVT73X | Foundation Elective-X | CV | 3-0-0-0 | 3 | 100 |
| 4 | 15CVT74X | Engineering Elective-XI / PBL | CV | 3-0-0-0 | 3 | 100 |
| 5 | 15HOE75X | Open Elective-XII | CV/BS&H/ME | 2-0-0-4 | 3 | 100 |
| 6 | 15HOE76X | Open Elective-XIII | CV/BS&H | 2-0-0-4 | 3 | 100 |
| 7 | 15CVL77 | Project Management Lab | CV | 0-0-2-0 | 1 | 100 |
| 8 | 15CVL78 | Analysis and Design Lab-II | CV | 1-0-2-0 | 2 | 100 |
| 9 | 15CVP79 | Project Phase-I | CV | 1-0-4-0 | 3 | 100 |
| **Total** | | | | **18-0-12-8** | **26** | **900** |

## Foundation Elective – X

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT731 | Construction Industry Practice-III |
| 2 | 15CVT732 | Pre-Stressed Concrete Structures |
| 3 | 15CVT733 | Pavement Design |

## Engineering Elective – XI / PBL

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15CVT741 | Fire safety and management |
| 2 | 15CVT742 | Fundamentals of Energy, Environment and climate change |
| 3 | 15CVT743 | Industrial Waste Water treatment |

## Open Elective – XII

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15HOE751 | Tax Management |
| 2 | 15HOE752 | Assessment of Building Energy Performance (Offered by ASHRAE) |
| 3 | 15HOE753 | Natural Disaster Mitigation and Management |
| 4 | 15HOE754 | Online Certification courses from IITs / IISc / SWAYAM / EDX |

## Open Elective – XIII

| Sl. No. | Course Code | Course |
|---|---|---|
| 1 | 15HOE761 | Small and Medium Enterprise Management |
| 2 | 15HOE762 | Occupational Safety and Health Administration |
| 3 | 15HOE763 | Animation and Multimedia Engineering |
| 4 | 15HOE764 | Online Certification courses from IITs / IISc / SWAYAM / EDX |

## Eighth Semester B.E. – Scheme

| Sl. No. | Course Code | Course | Teaching Dept. | Total Credits | Marks |
|---|---|---|---|---|---|
| 1 | 15CVP81 | Project Phase-II | CV | 4 | 100 |
| 2 | 15CVP82 | Project Phase-III | CV | 4 | 100 |
| 3 | 15CVP83 | Evaluation and Viva voce (External) | CV | 10 | 100 |
| | | **Total** | | **18** | **300** |

**IC – Integrated Course** **L – Lecture** **T-Tutorials**
**P-Practical** **S – Self Study**

# Engineering Mathematics-III (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVM31 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | BS |

## Course Objectives:

The students will be able to :

- The course is aimed at developing the application of mathematical skills in solving the engineering problems using computers.
- Learn to use the partial differential equations in engineering applications.
- Use of Transforms in the engineering problems.
- Able to find the approximated solutions to engineering problems numerically.

## Syllabus

### Module - I

**Partial Differential Equations:** Formation of PDE –Eliminating the Arbitrary constants and arbitrary functions, solutions of non homogenous PDE by direct integration. Method of separation of variables. Applications to PDE –Derivation of one dimensional of wave equation and solution by separation of variables-with specified boundary conditions. Derivation of one dimensional of Heat equation and solution by separation of variables-with specified boundary conditions. **08 Hours**

### Module - II

**Fourier Series:** Periodic functions, Dirchlet's conditions, Euler's Formulae-Fourier series of periodic functions of period 2l and 2π, Half range Fourier series , Practical harmonic analysis. **08 Hours**

### Module - III

**Fourier –Transform and Calculus of Variations:** Infinite Fourier Transform, Fourier Sine and Cosine Transform. Variation of function and a functional. Extremal of a functional, variational problems, Euler's equation, Standard Variational problems including Geodesics, minimal surfaces of Revolution, hanging chain and Brachistochrone problems. **08 Hours**

### Module - IV

**Numerical Methods:** Numerical solutions of Algebraic and transcendental equations-Regula False Method and Newton Raphson Method. Finite Differences-Forward, Backward and central differences, Newton's Forward, Newton's Backward and Sterling's interpolation formulae. Lagrange's Interpolation formula (without proof). Numerical Differentiation using Newton's Forward and Backward formulae. **08 Hours**

## Module - V

Introduction to MATLAB, and Its family, Menus and toolbars, Types of windows and types of files, MATLAB Help system, Basic calculations in MATLAB, Basic variables, Functions–Elementary Mathematical, Built in and User defined functions. Array operations, Matrix operations, Loops: for and while loops, condition statements: if-then and if-then-else statements, plotting of graphs, working with scripts and files, approximations and errors using MATLAB, solutions of initial value problems, solutions of system of equations. **08 Hours**

## List of MATLAB Experiments

| Sl. No | Name of Experiment |
|---|---|
| 01 | Basics of MATLAB |
| 02 | Basic operations in MATLAB |
| 03 | Basic Vector operations |
| 04 | Basic Matrix operations |
| | Solution of Linear Equations |
| | Determination of Eigen values and Eigen vectors of a Square Matrix |
| | Solution of Linear Equations for Undetermined and Over determined Cases. |
| 05 | Basic Operations on Complex Numbers |
| 06 | Plotting of 2D and 3D Curves |
| 07 | Polynomial Evaluation and Determination of Roots of a Polynomial |
| | Determination of Polynomial using Method of Least Square Curve Fitting |
| | Determination of Polynomial Fit, Analyzing Residuals, Exponential fit and Error Bounds from Given Data |
| 08 | Use of Functions |
| 09 | Differentiation and Integration |
| 10 | Solution of linear differential equations |
| | Numerical Solutions of Ordinary Differential Equations by Euler's Method |
| | Numerical Solutions of Ordinary Differential Equations by $4^{th}$ order Runge Kutta Method |

## Course Outcomes:

On completion of this course, the students are able to :

- Form a partial differential equations and their solutions.
- Expressing the given functions as infinite series of sine and cosine.
- Find approximated solutions by numerical methods.
- Use the MATLAB to solve the various types engineering problems.

## Text Books:

1. Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 10,17,18, 22, 23, 28-30), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN No.: 9788174091956.
2. N.P. Bali and Dr. Manish Goyal: "A Text Book of Engineering Mathematics", (Chapters 10,16,17,20,22,23), Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2014, ISBN: 9788131808320.
3. Rudrapratab: "Getting started with MATLAB", (Chapters 1-4), Oxford University Press, United Kingdom, Indian Edition, 2014 (reprinted).

## Reference Books:

1. Erwin Kreyszig: "Advanced Engineering Mathematics", (Chapters 11,12,19), Wiley Pvt. Ltd., India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.
2. B.V. Ramana: "Higher Engineering Mathematics", (Chapters 17-21,32), Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.
3. S.S. Sastry: "Introductory methods of numerical analysis", (Chapters 2,3,6), PHI learning private, Delhi, 5th Edition, 2013, ISBN: 978-81-203-4592-8.
4. Stormy Attaway: "A practical introduction to programming and problem solving", Elsevier, Boston, 2nd Edition.

## E-Resources:

1. http://bookboon.com/en/essential-engineering-mathematics-ebook
2. https://www.free-ebooks.net/ebook/essential-engineering-mathematics
3. http://www.zums.ac.ir/ebooks/mathematics/essential-engineering-mathematic.
4. https://archive.org/details/AdvancedEngineeringMathematics10thEdition
5. www.mathworks.com

# Building Materials and Concrete Technology

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT32 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Achieve the basic knowledge of concrete.
- Understand the advances in construction materials.
- Learn the importance of materials used in concrete.
- Understand fresh concrete properties and admixtures.
- Utilise the Codal provisions for concrete mix design.

## Syllabus

### Module - I

**Masonry:** Definition of terms used in Masonry, Classification of Masonry.

**Stone Masonry**: Classification, joints.

**Brick Masonry:** Manufacture of Bricks, Standard properties of brick, Field test.

**Block Masonry:** Classification and properties.

**Foundation:** Importance and requirements of a good foundation, types of foundation, Preliminary investigation of soil, safe bearing capacity of soil, Introduction to spread, combined, strap, mat and pile foundations. **08 Hours**

### Module - II

**Roofs:** Types of roofs and roofing materials, Flat roof (RCC), types of pitched roofs, Introduction to Form Work and Scaffolding.

**Plastering:** Purposes of plastering, Materials of Plastering, Methods of plastering, Defects in plastering.

**Painting**: Introduction to paintings and types of painting, Purpose of painting, defects in painting, application of paints to new and old surfaces. **08 Hours**

### Module - III

**Cement:** Chemical composition, hydration of cement, types of cement, manufacture of OPC with flow charts. Bogue's compound, Tests on cement – field and Lab test, Quality of mixing water.

**Fine aggregate**: Grading of aggregates, sieve analysis, specific gravity, bulking, and moisture content, deleterious materials.

**Coarse aggregate:** Importance of size, shape and texture, grading of aggregates,

sieve analysis, specific gravity, flakiness and elongation index, crushing, impact and abrasion tests, Structure of aggregate phase, structure of hydrated cement paste, structure - property relationship in hydrated cement paste. **08 Hours**

## Module - IV

**Concrete**: Ingredients, Manufacture of concrete.

**Workability:** Definition, factors affecting workability, measurement of workability by slump, compaction factor, vee-bee, flow tests. Segregation and bleeding, process of manufacture of concrete – batching. Mixing, transporting, placing, compaction, curing of concrete.

**Hardened concrete:** Test on Compression, tensile, Flexural.

**Admixtures**: Chemical and Mineral Admixtures. **08 Hours**

## Module - V

**Shrinkage and creep:** Factors affecting Shrinkage, Drying and Plastic Shrinkage. Factors affecting creep, effects of creep.

**Durability**: Definition, Permeability, sulphate attack, Chloride attack, Carbonation freezing and Thawing, factors contributing to cracks in concrete.

**Mix design**: Concept of mix design, procedure of mix design as per IS 10262-2009, numerical examples of mix design. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Recognise the materials used in construction.
- Describe the physical and mechanical properties of a variety of construction materials.
- Identify the functional components of a building.
- Describe the construction process of various components of a building.
- Explain the fundamental principles and procedures in preparing concrete.

## Text Books:

1. M.S. Shetty: “Concrete Technology”, (Chapters 1-3,6-9,11), Theory and Practice, S. Chand and Company, New Delhi, 7th Edition, ISBN-13: 9788121900034.
2. Neville A.M : “Properties of Concrete”, (Chapters 1,3-6,9,10,14), ELBS, London, 4th Edition, ISBN: 9780582230705.
3. S K Duggal: “Building materials”, (Chapters 2,3,6,10), New Age International Publishers, India, 4th Revised Edition, ISBN 10: 81224337900.
4. Rangawala P C: “Engineering Materials (Material Science)”, (Chapters 3, 4, 8, 9), Charotar Publishing House, India, 33rd Edition, 2015, ISBN: 978-93-85039-04-1.

## Reference Books:

1. Gambhir M.L : "Concrete Technology", (Chapters 1-4,6,8,11,15), Dhanpat Rai and Sons, New Delhi, 4th Edition, ISBN: 978125906255.
2. P. G. Varghese: "A Textbook Building Materials", (Chapters 1,3,19), PHI Learning Publication, 2nd Edition, 2015, ISBN: 81-203-2848-5.
3. IS:10262-2009, Recommended guidelines for concrete Mix design.

## E-Resources:

1. www.atozcivilengineering.com › Education
2. www.actemirates.ae
3. www.advconcrete.com/contact-us
4. www.act-course.co.uk
5. www.labour.gov.hk/eng/public/os/D/Constructionsite.pdf

# Strength of Materials

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT33 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives :

The students will be able to :

- Study the behaviour of materials within elastic limit subjected to Flexure, Shear and Torsion.
- Analyze the buckling behaviour of columns.
- Understand the importance of deflection in beams.
- Analyze the complex stresses.

## Syllabus

### Module - I

**Simple Stress and Strain:** Introduction, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain diagram for structural steel, Principle of superposition, Elastic constants, relationship among elastic constants. **08 Hours**

### Module - II

**Bending Moment and Shear Force:** Introduction, Shear force, Bending moment, Relationship between loading, shear force and bending moment, SFD and BMD with salient values for simply supported beams, cantilever beams and overhanging beams considering point loads, UDL, UVL and Moment. **08 Hours**

### Module - III

**Torsion of circular shafts:** Pure torsion, torsion equation of circular shafts, torsional rigidity and polar modulus, Power transmitted by shaft for solid and hollow circular shafts.

**Elastic stability of columns:** Short and long columns, Euler's theory on long columns, Effective length, slenderness ratio, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula. **08 Hours**

### Module - IV

**Deflection of beams:** Definitions of slope, deflection, Elastic curve, derivation of differential equation for deflection, Sign convention, Slope and deflection for standard loading cases using Macaulay's method for beams subjected to point loads, UDL and moment.

**Compound stresses**: Introduction, Stress components on inclined planes, General

two dimensional stress system, Principal planes and stresses, Mohr's circle of stresses and complimentary shear stress. **08 Hours**

## Module - V

**Bending Stress in Beams:** Introduction to Bending stress in beams, Assumptions in pure bending and derivation of Bending equation, Modulus of rupture, section modulus, Moment of resistance and Flexural rigidity.

**Shear Stress in Beams:** Expression for shear stress in beam, Shear stress diagram for rectangular, symmetrical 'I' and 'T' section. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Describe the fundamental concepts of stress and strain under elastic limits.
- Draw SFD and BMD for beams.
- Design shafts to transmit required power.
- Determine the buckling loads of long columns.
- Determine deflection in beams under different loading conditions.
- Analyze the major and minor principal stresses and their directions.
- Analyze the bending stress and shear stress in the beams.

## Text Books:

1. Dr. R K Bansal: "A Textbook of Strength of Materials", (Chapters 1-3,6,7,9,12), Laxmi Publisher, 5th Edition, 2012, ISBN: 978-8131808146.
2. S Ramamrutham and R Narayanan: "Strength of Materials", (Chapters 1,2,5,7,9), Dhanpat Rai Publishing Company, 14th Edition, 2011, ISBN:9788187433545.

## Reference Books:

1. S S Bhavikatti: "Strength of Materials", (Chapters 1,2,4,7,8,10), S.Chand (G/L) and Company Ltd., 4th Edition, 2013, ISBN: 978-9325971578.
2. Dr. B C Punmia, Dr. A K Jain: "Mechanics of Materials", (Chapters 1- 5,7,11,12), Fire Wall Media, 2002, ISBN: 9788170082156.

## E-Recourses:

1. http://elearning.vtu.ac.in/elcmys/P1/CV33/3/ReloadContentPreview.htm
2. http://elearning.vtu.ac.in/elcmys/P1/CV33/2/ReloadContentPreview.htm
3. http://elearning.vtu.ac.in/elcmys/17/e-Notes/10CV52/Unit2-GSS.pdf
4. http://elearning.vtu.ac.in/elcmys/17/e-Notes/10CV52/Unit2-GSS.pdf

# Surveying

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT34 | 4:0:0:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Learn basics of surveying and expose different techniques of surveying.
- Understand the principles of Tacheometry, geodetic surveying and GPS.
- Identify the types of errors encountered in surveying.

## Syllabus

### Module - I

**Introduction to Surveying:** Introduction to plane surveying, Chain and tape measurement, Meridians, Azimuths and bearings – Theodolites – Temporary and permanent adjustment – Horizontal and Vertical angle measurements – Electronic total station. **10 Hours**

### Module - II

**Introduction to levelling:** Differential levelling, longitudinal and cross section levelling, refraction and curvature correction, reciprocal leveling - Tacheometry – Stadia tacheometry, tangential tacheometry and substance tacheometry- Contouring, methods of contouring. **10 Hours**

### Module - III

**Areas, volumes and GPS:** Area, volume calculation of earth work - Introduction to Global positioning system – GPS surveying methods. **10 Hours**

### Module - IV

**Curve Setting:** Definitions, designation of curve, elements of simple curve - settings of simple circular curve, compound and reverse curve- transition curve – Introduction to vertical curves. **10 Hours**

### Module - V

**Introduction to geodetic surveying:** Triangulation surveying – base line measurement and correction, satellite station. Surveying adjustments – principle of least square and adjustment of triangulation network. **10 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Identify the basics involved in different types of surveying like tape, compass, levelling, and Theodolite (total station).
- Recognize the skills in performing measurement of distance, angles, levelling.
- Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
- Develop skill to carry out tacheometry, geodetic surveying wherever situation demands and curve setting.
- Apply error adjustment to the recorded reading to get an accurate surveying output.

## Text Books:

1. Dr B C Punmia: "Surveying Volume I", (Chapters 1-4,6,7,9,13,16,18,22), Lakshmi Publications Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.
2. Dr B C Punmia: "Surveying Volume II", (Chapters 1-4,6,7,15), Lakshmi Publications Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.

## Reference Books:

1. C Venkatramaiah: " Text Book of Surveying", (Chapters 1-5,7-10,11,12), Universities Press (India) Pvt. Ltd., 5th Edition, 1996, ISBN: 9788187433545.
2. S.K. Roy: "Fundamentals of Surveying", (Chapters 1,3,19), Prentice-Hall Of India Pvt. Limited, 2004, 2nd Edition, ISBN: 81-20-312-60-0.

## E-Resources:

1. http://lib.uniten.edu.my/libsite/index.php?option=com_joomdandview=itemandlayout=detailandtypeid=2andid=202andItemid=790
2. http://ascelibrary.org/journal/jsued2
3. www.survivorlibrary.com/engineers_surveying_instruments_1892.pdf

# Engineering Geology (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI35 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- The principles of engineering Geology.
- Earth resources and their properties, Earth processes and natural hazards.
- Earths structures and their impact on engineering construction.

## Syllabus

### Module - I

**Introduction:** Geology and its role in the field of civil engineering. Earth: Its internal structure and composition.

**Geodynamics:** Earthquakes- seismic waves, seismograph, causes, effects, seismic zones, shield areas and seismic resisting structures. Coastal zones, coastal landforms, continental shelf, continental rise, continental slope, abyssal plain, mid-oceanic ridges, trenches, tsunamis. Land slides: causes, effects and remedial measures.

**Mineralogy:** Description and identification of Rock forming minerals and Ores, based on physical and special properties Quartz and its varieties; Feldspar group Mica group, carbonate group, Hornblende, Olivine, Asbestos, Talc, Gypsum, Garnet, Corundum. Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Psilomalane, Chromite, Galena, Bauxite. **08 Hours**

### Module - II

**Petrology:** Rocks as fundamental units and building materials of the earth crust and their engineering applications: As building stones, road metals and stones for decoration, pavement, cladding, roofing, flooring, concreting and foundation engineering.

**Igneous Rocks:** Origin, classification (chemical and textural), mode of occurrence; Identification and description of Granite, Syenite, Diorite, Gabbro, Dunite, Pegmatite, Porphiries, Dolerite, Rhyolite, Basalt and Pumice.

**Sedimentary Rocks:** Origin, classification, primary structures and description of Sandstones, Conglomerate, Breccia, Shale, Limestones and Laterite.

**Metamorphic Rocks:** Kinds of metamorphism, description of Gneiss, Quartzite, Marble, Slate, Phyllite and Schists. **08 Hours**

## Module - III

**Geomorphology:** Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures, Geological action of rivers with different drainage patterns; Geological action of wind. **08 Hours**

## Module - IV

**Rock Mechanics And Engineering Geology:** Stress, strain and deformational effects on different rocks, Out crop, Dip, strike and escarpment, Clinometer-compass-Joints, faults, folds and unconformities their effects on civil engineering structures. Geotechnical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the construction of Dams, Reservoirs, Tunnels, Bridges and Highways. **08 Hour**

## Module - V

**Hydro-geology:** Hydrological cycle, distribution of ground water in the earth crust, properties of water bearing geological formation: Aquifers and their types, selection of sites for well locations and spacing of wells, geological, hydrological and geophysical (electrical resistivity) investigations for ground water exploration; artificial recharge of groundwater methods and rain water harvesting. Sea water intrusion and remedial measures. **08 Hours**

| Lab Session | Topic for a session (3 hrs) | Tests/Assignments/ Tutorials |
|---|---|---|
| 1 | Minerals and rocks differentiation,<br>Classification of minerals in to different groups,<br>Physical properties of minerals,<br>Minerals identification- quartz group and its varieties. | Mineral identification<br>Chart preparation |
| 2 | Minerals identification- rock forming minerals-feldspars, micas, pyroxenes, amphiboles, carbonates, sulphate groups, garnet group, kaoline and talc, olivine group, corundum, other silicates. | Record sheets |
| 3 | Minerals identification- ore minerals: iron ores, chromium ores, aluminum ore, mn ores, sulphide group | Minerals record<br>Rocks identification<br>Chart preparation |

| | | |
|---|---|---|
| 4 | Rocks – texturesand structures, classification into igneous, sedimentary and metamorphic; and subgroups, identification of individual rocks Igneous rocks: granite, syenite, diorite, gabbro, dunite, porphyries, dolerite, pegmatite, basalt, rhyolite and pumice | Rocks and minerals Record preparation |
| 5 | Sedimentary rocks: sandstone, limestone, shale, breccia, conglomerate and laterite | Record sheets |
| 6 | Metamorphic rocks: gneiss, quartzite, marble, slate, phyllite, schists and charnockite | Record sheets<br>Rock identification<br>Record sheets- final |
| 7 | Maps – introduction, profiling, interpretation. Contour maps – simple, profile, interpretation | Maps and Record sheets |
| 8 | Geological maps- horizontal beds, profile and interpretations | Maps and Record sheets |
| 9 | Geological maps – inclined beds, fold, unconformity | Maps and Record sheets |
| 10 | Maps- faulted, and complicated | Maps and Record sheets |
| 11 | Preparation of drainage map using topo-sheet. | Choice practical |
| 12 | Evaluation by test (model lab test) | Mse (evaluation) |
| 13 | Dip and strike problems | Problems |
| 14 | Dip and strike problems | Problems |
| 15 | Bore hole problems | Problems |

## Course Outcomes:

On completion of this course, the students are able to :

- Describe earth and its internal structure.
- Explain Earth processes and its effect on engineering construction.
- Identify and estimate natural resources.
- Recognize good building materials and their properties.

## Text Books:

1. Parbin Singh: "Text of Engineering and General Geology", (Chapters 1-4,6,7,9,12-14,17-25), S. K. Kataria and Sons, New Delhi, 8th Revised Edition, 2012, ISBN: 9788188458516.
2. Chenna Kesavulu: "A text book of Engineering Geology", (Chapters 2-10,12-14, 17-19), Mac Millan India Ltd., 2nd Edition, 2009, ISBN:9780230638709.
3. G.B Mahapatra: "A text book of geology", (Chapters 1-3,5,6,11,12,14,20-23,25,26), CBS Publishers, 1st Edition, 1987, ISBN: 9788123900131.
4. Dimitri P. Krynine and William R. Judd: "Principles of Engineering Geology and Geotechnics", (Chapters 1,2), ISBN : 9788123906034.

## Reference Books:

1. M. P. Billings : "Structural Geology", (Chapters 3-5), Prentice Hall of India Pvt. Ltd., New Delhi, 3rd Edition, ISBN: 9780203894538.
2. Tony Waltham: "Foundations of Engineering Geology", (Chapters 1-5), CRC Universities Press, 3rd Edition, ISBN: 9780415469609.

## E-Resources:

1. http://elearning.vtu.ac.in/elcmys/18/enotes/06CV834/Unit1and2-SKP.pdf
2. http://elearning.vtu.ac.in/elcmys/P5/enotes/CV/S3-HSR.pdf
3. http://elearning.vtu.ac.in/elcmys/P6/enotes/EE61/Unit1-8.pdf
4. http://www.srividyaengg.ac.in/elearn1/coursematerial/Civil/103331.pdf
5. http://www.slideshare.net/gauravhtandon1/engineering-geology-unit-i
6. http://www.dphu.org/uploads/attachements/books/books_2752_0.pdf
7. http://nptel.ac.in/courses/105105106/

# Ecology and Environmental Impact Assessment

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT361 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- Different ecological factors influencing environment.
- Frame work of Impact Assessment and various development projects.
- Assessment and Impact prediction on various features like air, water.
- Public Interest in Environmental Decision making.
- Salient Features of various Project Activity.

## Syllabus

### Module - I

**Ecology:** Development and evolution of ecosystems – Principles and concepts, Classification of Ecosystems, Structure and Function of Ecosystems, Energy flow in Ecosystems, Ecological Niche and succession, Bio-geo-chemical cycles, Ecological Pyramids.

**Aquatic and Terrestrial Ecosystems:** Diversity and dominance Indices, Ecosystem Models.

**Lake Ecosystem:** Trophic levels, nutrient loading, nutrient enrichment, Leibig's Law, control of eutrophication. **08 Hours**

### Module - II

**Environmental Impact Assessment:** Definition, Objectives, Development Activity and Ecological Factors EIA. Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by-step procedure for conducting EIA and Limitations of EIA, Prevention of Significant Deterioration (PSD) Programme. Carrying capacity concept. **08 Hours**

### Module - III

**Frame work of Impact assessment:** Scope and contents of EIA, methodologies and techniques of EIA. Frame work of Impact Assessment. Development Projects-Environmental Setting, Objectives and Scope, Contents of EIA.

**Prediction and Assessment:** Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for Development Projects, Rapid and Comprehensive EIA. **08 Hours**

## Module - IV

**Guidelines for Development:** EIA guidelines for Development Projects, Rapid and Comprehensive EIA. Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements. Salient Features of the Project Activity-Environmental Parameter Activity Relationships- Matrices. **08 Hours**

## Module - V

**EIA On Projects:** EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities. Case studies with present scenario. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Identify various ecological components influencing environment.
- Distinguish different methodologies, outlook of Impact assessment and development of many projects.
- Predict the impact of many components on environment.
- Assess the Public Interest in Environmental Decisions.
- Examine important features of different project activities.

## Text Books:

1. Jain R.K., L.V. Urban: "Environmental Impact Analysis", (Chapters 1-3), Nostrand Reinhold Co., ISBN: 9780071370080.
2. Anjaneyalu. Y, Valli Manickam: "Environment Impact Assessment," (Chapters 1-5,6-9,11), CRC Press, 2011, ISBN: 9780415665568.

## Reference Books:

1. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
2. Larry W. Canter: "Environment Impact Assessment", McGrawHill Publication.
3. Kormondy: "Concepts of Ecology", Prentice Hall Publication, New Jersey.
4. Odum: "Fundamentals of Ecology", Adisson Co.

## E-Resources:

1. https://en.wikipedia.org/wiki/Environmental_impact_assessment
2. https://scholar.google.co.in/scholar.
3. https://www.epa.gov/international-cooperation/technical-review-guidelines-environmental-impact-assessments-tourism.
4. https:// www.nptel.ac.in/courses/120108004

# Rural Water Supply and Sanitation

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT362 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- Water sources, water borne diseases and drinking water quality standards.
- Water treatment methods and to control contamination of water.
- The usage of pumps.
- Refuse collection system and disposal.
- Principles of rural sanitation and rain water harvesting.

## Syllabus

### Module - I

**Rural Water Supply:** Introduction: Need for a protected water supply, Investigation and selection of water sources, water borne diseases, Protection of well waters, drinking water quality standards. **08 Hours**

### Module - II

**Types of Pumps:** Supply systems viz., BWS, MWS, PWS, water treatment methods-disinfection, deflouridation, hardness and iron removal, ground water contamination and removal. **08 Hours**

### Module - III

**Rural Sanitation:** Conservancy, public latrine, concept of eco-sanitation, trenching and composing methods, two pit latrines, aqua privy, W.C, septic tank, soak pit.

**Drainage Systems:** Storm water and sullage disposal, rain water harvesting and uses. **08 Hours**

### Module - IV

**Communicable diseases:** Terminology, Classifications, Methods of communication, general methods of Control Refuse Collection and disposal: Garbage, ash, rubbish, collection methods, transportation and disposal-salvaging, dumping, controlled tipping, incineration and composting, dung disposal-digester, biogas plant. **08 Hours**

### Module - V

**Milk Sanitation:** Essentials, Test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed.

**Insect Control:** House fly and mosquito-life cycle, diseases, transmission and control measures. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Identify and select water supply systems in rural areas.
- Distinguish between urban and rural water supply systems.
- Categorize the different types of water borne and communicable diseases and apply the principles of rain water harvesting.
- Explain overall management of rural water supply and other components like milk sanitation.
- Examine overall management of solid waste collection, disposal and other components like composting of waste to energy.

## Text Books:

1. S. K Garg: "Water Supply Engineering," (Chapters 1-3), Khanna Publishers, Delhi, 26th Edition, 2012, ISBN: 978-8174091208.
2 E.William: "Steel, Water Supply and Sewerage", (Chapters 4,5), McGraw-Hill Publishers, Delhi, 28th Edition, 2011, ISBN: 978-0471523772.

## References Books:

1. K.Park: "Preventive and Social medicine", (Chapters 4,5), Bhanot Publishers, Jabalpur (M.P ,India), 23rd Edition, 2015, ISBN: 978-9382219057.
2. Joseph. A. Solveto: "Environmental Engineering and Sanitation", (Chapters1-3), Wiley-Interscience Publishers, New Delhi, 4th Edition, 2012, ISBN: 978-0471523772.

## E-Resources:

1. http://nptel.ac.in/courses/105105048/
2. http://nptel.ac.in/courses/105104102/

# Solid Waste Management

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT363 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- Characterize the waste and apply the knowledge of laws for municipal solid waste management and disposal of biomedical wastes and plastic wastes.
- Apply the knowledge of mathematics, science, and engineering for effective solid wastes collection systems, waste collection route optimization and processing of solid waste.
- Understand composting systems, maintenance and operation of aerobic and anaerobic composting processes for effective organic waste recycling.
- Know construction and operations of landfill facilities, energy recovery systems and management of leachate systems.

## Syllabus

### Module - I

Definition of solid wastes, Land Pollution-scope and importance of solid waste management, functional elements of solid waste management.

**Sources:** Classification and characteristics of solid wastes, Municipal Solid Waste, Commercial and Industrial. Method of quantification. Biomedical Waste Handling Rules and Recycled Plastic usage Rules. **08 Hours**

### Module - II

**Collection of solid waste:** Systems of collection of solid wastes, transfer stations-bailing and compacting, collection equipments, garbage chutes, route optimization techniques and numerical problems on route optimization.

**Incineration:** Incineration process-3 T's, factors affecting incineration process, incinerators-types, prevention of air pollution, pyrolsis, design criteria for incineration. **08 Hours**

### Module - III

**Composting:** Composting, factors affecting composting process, aerobic and anaerobic composting, Indore and Bangalore method of composting, mechanical composting process, vermi-composting. **08 Hours**

## Module - IV

**Landfills:** Sanitary land filling –Different types, trench method, area method, ramp method and pit method. Factors considered for a landfill site selection, Prevention of site pollution. Cell design, leachate collection systems, control of gas movement and gas recovery systems. Geo-synthetic fabrics in sanitary landfills. **08 Hours**

## Module - V

**Disposal Methods:** Open dumping-selection of site, ocean disposal, feeding to hogs, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, plastic waste, Biomedical waste and its impact on Human health. **08 Hours**

### Course Outcomes:

On completion of this course, the students are able to :

- Explain Components of solid waste management and the laws governing it.
- Describe the solid waste collection systems, route optimization techniques and processing of solid wastes.
- Design, operation and maintenance of landfills and composting units.
- Discuss the importance and techniques of all major and minor methods of disposal considering plastic and biomedical waste.

### Text Books:

1. Howard S.Peavy et.al: "Environmental Engineering", (Chapters 10-13), Mc-Graw-Hill Book Company, New York, 2012, ISBN: 978-0071002318.
2. George Tchobanoglous et.al.,: "Integrated Solid Waste Management", (Chapters 1-5), Mc-Graw-Hill Inc., New York, 2013, ISBN: 9780070632370.

### Reference Books:

1. K Sasikumar: "Solid Waste management", (Chapters 1-4), PHI Learning Pvt. Limited, New Delhi, 13th Edition, ISBN: 9788120338692.
2. S.K Garg: "Environmental Engineering (Vol II)", (Chapters 9-12), Khanna Publishers, New Delhi, 2009, ISBN: 9788174092304.

# Basic Material Testing Laboratory

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL37 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Apply the knowledge of Mathematics and Engineering in calculating the mechanical properties like tensile strength, compressive strength, bending strength, and shear strength, hardness of mild steel, cast iron, wood and other construction materials.

## Syllabus

1. Tests on Fine aggregates – Specific gravity, Sieve analysis and Bulking.
2. Tests on Coarse aggregates – Specific gravity and Sieve analysis.
3. Tension test on Mild steel bars.
4. Compression test on Cast iron.
5. Torsion test on Mild Steel circular sections.
6. Bending test on Wood Under two point loading.
7. Shear Test on Mild steel.
8. Impact test on Mild Steel (Charpy and Izod).
9. Hardness tests on ferrous and non-ferrous metals – Brinell's, Rockwell and Vicker's.
10. Test on Bricks and Tiles.

## Course Outcomes:

On completion of this course, the students are able to :

- Interpret basic knowledge of mathematics, science and engineering in finding the strength in tension, compression, shear and torsion.
- Identify and solve engineering problems of structural elements subjected to flexure.
- Decide the techniques, skills, and modern engineering tools necessary for engineering applications.

## Text Books:

1. Dr. B.C Punmia: "Mechanics of Materials Volume-I", (Chapters 1-3,7), Lakshmi Publications, 1st Edition, 2014, ISBN: 978-81-318-0646-3.
2. F. P. Beer and E. R. Johnston: "Vector Mechanics for Engineers – Volume I- Statics", (Chapters 1-5,7,9), Tata McGraw Hill, 9th Edition, 2011, ISBN: 0-07-058828-7.

## Reference Books:

1. P. G. Varghese: "A Textbook Building Materials", (Chapters 1,3,19), PHI Learning Publication, 2nd Edition, 2015, ISBN: 81-203-2848-5.
2. Neville A. M and Brooks J. J: "Concrete Technology", (Chapters 1,2), ELBS Edition, London, 2nd Edition, 2010, ISBN: 978-81-317-0536-0.
3. M.G. Shah, C.M. Kale and S.Y. Patki: "Building Drawing", (Chapter 1), Tata McGraw Hill Education Pvt. Ltd., New Delhi, 5th Edition, 2012, ISBN: 0-07-463876-9.

## E-Resources:

1. www.eng.mu.edu/CEEN162-Lab1-S09-Sieve-SpecificGravity.pdf
2. www.reviewmylife.co.uk/blog/compression-of-cast-iron-experiment
3. www.madinpoly.com/pdf/1/CE-Material%20Testing%20Lab.pdf
4. www.santarosa.edu/~yataiiya/E45/Bend%20Test%20of%20wood.pdf

# Surveying Practice-I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL38 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Impart the practical knowledge of different surveying instruments.
- Train the students in the usage of different surveying instruments.
- Study the different methods adopted in surveying practically.

## Syllabus

### Exercise– 1

a) To measure distance between two points using direct ranging.

b) To set out perpendiculars at various points on given line using cross staff, optical square and tape.

### Exercise – 2

Setting out of rectangle, hexagon using tape/chain and other accessories.

### Exercise – 3

To set out rectangles, pentagon, hexagon, using tape /chain and compass.

### Exercise – 4

To determine the distance between two inaccessible points using compass.

### Exercise –5

To determine difference in elevation between two points using fly leveling technique and to conduct fly back leveling. Booking of levels using both HI and Rise and Fall methods.

### Exercise – 6

To determine difference in elevation between two points using reciprocal leveling and to determine the collimation error.

### Exercise – 7

To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.

## Demonstration

Minor instruments – Clinometer, Ceylon ghat tracer, Hand level, Box sextant, Planimeter and Pantagraph.

## Course Outcome

On completion of this course, the students are able to :

- Explain principles involved in different instruments used in surveying.
- Apply the concept of basic mathematics and its application in surveying.
- Develop skill to measure vertical distances using dumpy level.
- Determine ground profile by different methods of levelling.

## Text Books:

1. Dr B C Punmia: "Surveying Volume I", (Chapters 1-4,6,7,9-13,16,18,22), Lakshmi Publications Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.
2. Dr B C Punmia: "Surveying Volume II", (Chapters 1-4,6,7,15), Lakshmi Publications, Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.

## Reference Books:

1. C Venkatramaiah: "Text Book of Surveying", (Chapters 1-5,7-12), Universities Press (India) Pvt. Ltd., 5th Edition, 1996, ISBN: 978-81-700-8853-0.
2. S.K. Roy: "Fundamentals of Surveying", (Chapters 1,3,19), Prentice-Hall of India Pvt. Limited, 2004, 2nd Edition, ISBN: 81-20-312-60-0.

## E-Resources:

1. http://lib.uniten.edu.my/libsite/index.php?option=com_joomdandview=itemandlayout=detailandtypeid=2andid=202andItemid=790
2. http://ascelibrary.org/journal/jsued2
3. www.survivorlibrary.com/engineers_surveying_instruments_1892.pdf

# Soft Skills Development

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVH39 | 0:2:0:0 | 1 | CIE:50 SEE:50 | 2 Hours | HSS |

## Course Objectives:

The students will be able to :

- Improve the communication skills.
- Develop the art of presentation and writing effectively.
- Enhance the technical knowledge.

## Syllabus

To improve the communication and presentation skills, every student has to give a seminar on technical topics assigned by the supervisors. Each course coordinator/ faculty members will be assigned with few students to guide and monitor the presentation. The presentation shall be for 15 minutes. A brief report on the seminar has to be submitted by the student to the concerned department after completion of the seminar. The report shall be signed by the supervisor and the Head of the concerned department.

The objective of the seminar is to introduce students to the major constituent of technology that is concerned with critically reading, understanding, summarizing, explaining and presenting existing technical topics. Students have to refer one or more topics that are assigned to them by their supervisors. The idea behind the seminar system is to familiarize student more extensively with the methodology of their chosen subject, allow them to develop presentation skills, and also interact with example of practical problems.

## Course Outcomes:

On completion of this course, the students are able to :

- Overcome stage fear and answer questions from audience.
- Communicate confidently and fluently.
- Comprehend and prepare reports effectively.

# Engineering Mathematics-IV

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVM41 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | BS |

## Course Objectives:

This course will enable students to :

- Develop the application of mathematical skills in solving statistics and probability problems using computers.
- Find differentiation, integration and solutions of differential equations using numerical methods.
- Analyse of complex variable functions, Introduction of Statistical Software's.

## Syllabus

### Module - I

**Numerical Methods-I:** Numerical Integration-Trapezoidal rule, Simpson's 1/3$^{rd}$ and 3/8$^{th}$ rule. Numerical solutions of ordinary differential equations of first order and first degree- Picard's method, Taylor's Series method, Modified Euler's Method, Runge-Kutta Method of 4$^{th}$ order and Milne's Predictor Corrector Method. **08 Hours**

### Module - II

**Numerical Methods-II:** Numerical solutions of simultaneous first order ordinary differential equations: Picard's method and Runge- Kutta method of fourth order. Numerical solutions of second order ordinary differential equations: Picard's method and Runge-Kutta method of fourth order. Numerical solutions of partial differential equations:-One dimensional heat equation. one dimensional wave equation**.**

**08 Hours**

### Module - III

**Complex variables:** Functions of a complex variable, derivative of complex functions. Analytic functions: Cauchy's-Riemann equations in Cartesian and polar forms (No problems by using limits), Harmonic functions, construction of analytic functions by using Milne-Thomson method. Cauchy Theorem, Cauchy's integral formula-problems. **08 Hours**

### Module - IV

**Probability and statistics:** Probability distributions: Poisson distribution, Poisson distribution is the limiting case of binomial distribution. Constants of Poisson distribution (no proof), Continuous random variable, Continuous probability distribution, Normal distribution ( no proof)-problems.

**Sampling and inference:** Sampling distribution, testing of hypothesis, level of significance, confidence limits. Test of significance of large samples, sampling of variables, central limit theorem, confidence limits for unknown means, students t-distribution. **08 Hours**

## Module - V

Introduction to R, Basic Data types, vector operations, matrix construction, lists, data frames, Elementary statistics with R-Qualitative and Quantitative data, Numerical measures, probability distribution, interval estimation and simple linear regression. **08 Hours**

## List of Lab Experiments

| Sl. No | Name of the Experiment |
|---|---|
| 1 | Introduction to R Software and basic commands |
| 2 | Demonstration and operations of Vectors |
| 3 | Operations of Matrices |
| 4 | Demonstration of Lists |
| 5 | Demonstration of Data Frames |
| 6 | Qualitative Data Analysis |
| 7 | Quantitative Data Analysis |
| 8 | Numerical Measures of Data |
| 9 | Probability Distribution |
| 10 | Linear Regressions |

## Course Outcomes:

On completion of this course, the students are able to :

- Determine the Differentiation, Integration and solutions of Differential equations using numerical methods.
- Find the differentiation and integrals of complex functions.
- Find the probability using different distributions and analysis by using samplings
- Use the statistical software's.

## Text Books:

1. Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 20,26,27,30,32, 33), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN: 9788174091956.
2. N.P. Bali and Dr. Manish Goyal, "A Text Book of Engineering Mathematics", (Chapters : 19,21,22,24,25), Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2014, ISBN: 9788131808320.
3. W.N.Venables, D.M.Smith : "An introduction to R. R- manual".

## Reference Books:

1. Erwin Kreyszig: "Advanced Engineering Mathematics", (Chapters 13, 14,19,21,24,25), Wiley Pvt. Ltd., India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.
2. B.V. Ramana: "Higher Engineering Mathematics", (Chapters 22,23,27-29,32,33), Tata McGraw – Hill Publishing Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.
3. S.S.Sastry: "Introductory methods of numerical analysis", (Chapters 6,8,9), PHI Learning Private Ltd., Delhi, 5th Edition, 2013, ISBN: 978-81-203-4592-8.
4. John Verzani: "Using R for introductory Statistics", Champan and Hall/ CRC, New York, Washington D.C., ISBN: 978-1-59327-384-2.

## E-Resources:

1. http://www.zums.ac.ir/ebooks/mathematics/essential-engineering-mathematic.
2. https://archive.org/details/AdvancedEngineeringMathematics10thEdition
3. https://www.**r**-project.org/

# Fluid Mechanics

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT42 | 4:0:0:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- The basic concepts of fluid mechanics, its classification and their applications in engineering.
- The knowledge, skills and ability to solve the problems related to fluid-statics and fluid-dynamics.
- Different types of flow through pipes, losses and flow measurements.
- The concept of uniform and non uniform flow in open channels.
- The Working principle , efficiency and performance of centrifugal pumps and Hydraulic turbines.

## Syllabus

### Module - I

**Fluid Properties and Fluid Pressure:**

**Basic properties of fluid:** Introduction, Definition of Fluid, properties of fluid with units: Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Surface tension. Newton's law of viscosity (theory and problems).

**Pressure and its Measurement:** Definition of pressure, Pressure at a point, Pascal's law. Types of pressure. Vapour pressure. Measurement of pressure using simple, differential manometers (theory and problems). **10 Hours**

### Module - II

**Hydrostatic Pressure on Surfaces:** Introduction, Definitions Total pressure and Centre of pressure, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged plane -Problems.

**Kinematics and Dynamics of Fluid Flow:** Introductions, methods of describing fluid motion, definitions of types of fluid flow, streamline, path line. Three dimensional continuity equation in Cartesian Coordinates (derivation and problems). Bernoulli's equation using Euler's equation of motion with assumptions and limitations (Problems). **10 Hours**

## Module - III

**Pipe Flow:** Introduction, Major and minor losses in pipe flow, Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel -problems. ( Theory and Problems).

**Discharge Measurements:** Introduction, Venturimeter, Orificemeter, Triangular notch, Rectangular notch, Cipolletti notch, Ogee weir and Broad crested weir, Small orifices- Problems. **10 Hours**

## Module - IV

**Open Channels Flow:**

**Uniform Flow:** Introduction, Geometric properties of Rectangular, Trapezoidal and Circular channels. Chezy's equation, Manning's equation-problems. Most economical open channels for rectangular, trapezoidal - problems.

**Non- Uniform Flow**: Introduction to Non-Uniform flow, Specific energy, Specific energy diagram, Conditions for Critical flow- Theory and problems. Hydraulic jump in a Horizontal Rectangular Channel- Theory and problems. **10 Hours**

## Module - V

**Centrifugal Pumps:** Introduction, Classification, Priming, methods of priming. Heads and Efficiencies. Equation for work done, minimum starting speed. Multistage Centrifugal Pumps (Pumps in Series and Pumps in parallel). Characteristic Curves for a Single stage Centrifugal Pumps- problems.

**Turbines:** Introduction, Classification of Turbines. Layout of hydroelectric Power plant

**Pelton wheel:** Components and working principle. Maximum power, Efficiency, working proportions- problems.

**Francis Turbines:** Components and working principle. Draft Tube: Types, Efficiency of a Draft tube and problems. **10 Hours**

### Course Outcomes:

On completion of this course, the students are able to :

- Describe the scope and importance of Fluid Mechanics. Learn types of fluid and properties of fluids, viscosity and its application. Analyze problems related to fluid pressure measurements.
- Identify the various forces acting on a fluid motion and the relation between pressure and velocity in a flow. Use principles of mathematics to represent kinematic concepts related to fluid flow.
- Analyse the flow mechanism in pipes along with various losses and their estimation with simple design of pipes.
- Distinguish between the concept of flow in open channels for uniform flow and Non-uniform Flow and concept of economical flow.

- Identify the pump required for different purposes and classify the turbines and explain design criteria.

## Text Books:

1. R. K. Bansal: "Text Book on Fluid mechanics and Hydraulic Machines", (Chapters 1-8), Laxmi Publications, 9th Edition, 2015, ISBN: 9788131808153.
2. R.K.Rajput: "A Textbook of Fluid mechanics and Hydraulic Machines", (Chapters 1-3,5,6,8,9,12,16), S.Chand and Co., New Delhi, 2006, ISBN: 9788121916677.
3. P.N.Modi, S.N.Seth: "Hydraulics and Fluid Mechanics", (Chapters 1-3, 6,8-11,14-16), Standard Book House, New Delhi, 20th Edition, 2015, ISBN: 978-81-89401-26-9.

## Reference Books:

1. Madan Mohan Das: "Fluid Mechanics and Turbo machines", (Chapters 1-3, 5-10,18,19), PHI Learning Pvt. Limited, New Delhi, 2009, ISBN: 978-81-203-3523-3.
2. N. Narayana Pillai: "Principles of Fluid Mechanics and Fluid Machines", (Chapters 1-3,9,10,15-17), Universities Press (India), Hyderabad, 2009, ISBN: 978-8173716751.

## E-Resources:

1. http://nptel.ac.in/courses/105101082/
2. http://elearning.vtu.ac.in/10CV35.html
3. http://nptel.ac.in/syllabus/syllabus.php?subjectId=112106185

# Structural Analysis-I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT43 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to

- Understand the concept of different structural systems.
- Learn the analysis of arches and cables.
- Get an exposure to deformation of different structural elements.

## Syllabus

### Module - I

**Introduction :** Forms of structures, Conditions of equilibrium, Degree of freedom, one, two and three dimensional structural systems, Determinate and indeterminate structures, Degree of Indeterminacy.

**Analysis of trusses**: Method of joints and Method of sections. **08 Hours**

### Module - II

**Arches and Cables :** Three hinged parabolic arches - Determination of Radial shear, normal thrust and bending moment. Two hinged parabolic arches, Analysis of cables under point load and UDL. **08 Hours**

### Module - III

**Deflection:** Moment area method and Conjugate beam method applied for beams.

**08 Hours**

### Module - IV

**Deflection:** Strain energy method applied to beams and trusses. **08 Hours**

### Module - V

**Analysis of beams:** Fixed beams, Clapeyron's theorem of three moments for continuous beams with different end conditions. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Identify different structural systems .
- Analyze the trusses by different methods.

- Determine forces and moments in arches and cables under different loading conditions.
- Compute the deflection of structural elements by different methods.
- Determine support moments for beams under different support conditions.

## Text Books:

1. S S Bhavikatti: "Structural Analysis - Vol. I", (Chapters 1,7,8,12), Vikas Publishing House, 4th Edition, 2009, ISBN: 9788125927907.
2. S Ramamrutham and R Narayan: "Theory of Structures", (Chapters 1,4,6,9), Dhanpat Rai Publishing Company Private Limited, New Delhi, 9th Edition, 2014, ISBN: 978-9384378103.

## Reference Books:

1. V. N Vazirani: "Analysis Of Structures Vol. 1: Analysis, Design And Details Of Structures", (Chapters 1,6,9), International Student Edition, Mcgraw Hill Book Co., New York, 2008, ISBN: 978-8174091406.
2. Reddy C. S: "Basic Structural Analysis", (Chapters 1,6,8), Tata McGraw Hill, New Delhi, 3rd Edition, 2010, ISBN: 9780070702769.

## E-Resources:

1. http://elearning.vtu.ac.in/elcmys/13/enotes/eceem/gr.pdf
2. http://elearning.vtu.ac.in/elcmys/e-con/stru_ana/ch5/html/0004.htm
3. http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters_05/html/0004.htm
4. http://elearning.vtu.ac.in/elcmys/struana.html

# Building Planning and Drawing (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI44 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Understand the principles of planning and bylaws.
- Draw plan, elevation and section of residential buildings.
- Study the functional planning of Public Health Centre, School Building, College canteen etc.
- Prepare detailed working drawing for doors, windows, footing, steel truss, staircase etc.
- Understand Electrical, water supply and sanitary services for a residential building.

## Syllabus

### Module - I

**Masonry:** Classification of Masonry, Definition of terms used in Masonry, introduction to classification and qualities of bricks, Bonds in Brick work - English Bond, Flemish Bond, Reinforced, Brick Masonry, Common building stones. **08 Hours**

### Module - II

**Stairs, Doors and Windows:** Definition of technical terms, Requirements of ground stair, Types of Stairs, Geometrical design of RCC Dog legged and open well stairs. Location of doors and windows, Definition of technical terms, Types of Doors, Types of windows, Varieties of materials for doors and windows and their properties.

**08 Hours**

### Module - III

**Functional Design of Building:** Design of Residential, Public and Industrial, positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio. **08 Hours**

## Module - IV

Development of plan, elevation, section and schedule of openings from the given line diagram of buildings using Auto CAD.

i) Single storied building
ii) Two storey building
iii) Office building
iv) Primary school building
v) Primary health centre.

**08 Hours**

## Module - V

For a given single line diagram, preparation of water supply, sanitary and electrical layouts. **08 Hours**

### Course Outcomes:

On completion of this course, the students are able to :

- Illustrate the knowledge of bonds in brick masonry.
- Recognize principles of planning using bylaws for buildings.
- Develop plan for Public Health Centre, School Building, College canteen.
- Draw plan, elevation and section for various residential buildings.
- Illustrate the knowledge of electrical, water supply and sanitary services for residential buildings.

### Text Books:

1. Shah M.H and Kale C.M: "Building Drawing", (Chapters 1,2), Tata McGraw Hill Publishing Co. Ltd., New Delhi, 5th Edition, 2011, ISBN : 9780071077873.
2. Rangawala P C: "Engineering Materials (Material Science)", (Chapters 3,4,8,9), Charotar Publishing House, India, 33rd Edition, 2015, ISBN: 978-93-85039-04-1.
3. P. G. Varghese: "A Textbook Building Materials", (Chapters 1,3,19), PHI Learning Publication, 2nd Edition, 2015, ISBN: 81-203-2848-5.

### Reference Books:

1. Gurucharan Singh: "Building Construction", (Chapters 1-4), Standard Publishers and distributors, New Delhi, 1st Edition, ISBN: 9788180140051.
2. National Building Code, BIS, New Delhi.

## E-Resources:

1. http://bbmp.gov.in/documents/10180/504904/Zoning_Regulations_RMP2015f.pdf/0a916060-b198-4903-b7cd-d18db7096ebdhttp://moud.gov.in/model-building bye laws bbmp.
2. https://www.jntubook.com/building-planning-drawing-textbook-free-download
3. http://www.avlib.in/ebook/title/building-drawing-by-shah-and-kale.html
4. http://pdfsu.com/book.php?q=Two%20Storey%20Autocad%20Building%20Drawing%20-%20clumagz.info

# Air Pollution and Control

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT451 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- The fundamentals of air pollution with a background on historical perspective on air pollution and current air quality policies and standards.
- Major air pollutants, their sources and their effects (environmental, economic and health) and how emissions are estimated from road traffic and industrial sources.
- Dispersion of air pollutants in the atmosphere.
- To analyze and present outputs of air quality models to a wide range of audiences.
- Different air quality monitoring equipments.

## Syllabus

### Module - I

**Introduction:** Definition – Classification and Characterization of Air Pollutants, Emission Sources, Behaviour and Fate of air pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced Smog.

**Effects of Air Pollution:** On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog and Bhopal Gas Tragedy. **08 Hours**

### Module - II

**Meteorology:** Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose, General Characteristics of Stack Plumes, Meteorological Models.

Factors to be considered in Industrial Plant Location and Planning, Noise pollution – sources, measurement units, effects and control. **08 Hours**

### Module - III

**Sampling, Analysis and Control:** Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement.

**Air Pollution Control Methods:** Particulate, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment. **08 Hours**

## Module - IV

Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

**Air Pollution due to Automobiles:** Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control. **08 Hours**

## Module - V

**Burning Environmental Issues:** Acid Rain, Global Warming, Ozone Depletion in Stratosphere, Indoor Air Pollution.

**Environmental Legislation:** Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards. **08 Hours**

### Course Outcomes:

On completion of this course, the students are able to :

- Examine emission standards for industrial and other sources.
- Identify air pollution concentrations as a function of emission, meteorology, topography and the built environment.
- Discuss impact of air pollution on health of humans, animals, plants and materials.
- Identify different equipments for air quality monitoring and control.
- Distinguish between global and local effects of air pollution.
- Recognize legal aspects of air pollution.

### Text Books:

1. Rao M.N. and Rao H.V.N : "Air Pollution", (Chapters 1-6), Tata-McGraw-Hill Publishing Company Ltd., New Delhi, India, 2011, ISBN 13: 978-0074518717.
2. Anjaneyulu Y: "Air Pollution and control Technologies", (Chapters 2-5), Allied Publishers, Delhi, 2012, ISBN-13: 9788177641844.
3. Rao C.S: "Environmental Pollution Control Engineering", (Chapters 2-6), New-age International Publishers, New Delhi, 2nd Edition, 2013, ISBN-13: 978-8122418354.

### References Books:

1. Gilbert M Masters: "Introduction To Environmental Engineering and Science", (Chapters 1-4), Pearson Education, 3rd Edition, 2007, ISBN-13: 978-0131481930.
2. Mahajan.S.P: "Pollution Control in Process Industries", (Chapters 1-5), Tata Mc-Graw Hill Publishing Co., New Delhi, 2010, ISBN-13: 978-0074517727.

### E-Resources:

1. http://nptel.ac.in/courses/105102089/
2. http://nptel.ac.in/courses/105104099/
3. nptel.ac.in/courses/103107084/module1/lecture1/lecture1.pdf

# Remote Sensing and GIS

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT452 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- The principles of Remote sensing and GIS.
- Remote sensing and GIS advantages in mapping.
- Application in the field of Civil engineering.

## Syllabus

### Module - I

**Principles of Remote Sensing:** Introduction to remote sensing, Remote sensing system. Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Active remote sensing. Passive Microwave Remote Sensing: Basics–physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, passive microwave scanners and sensors. **08 Hours**

### Module - II

**Platforms, Sensors and Data Products:** Ground aircraft, space aircraft platforms-photographic sensors, scanners, radiometers, Radar and Mission planning. Data types and format, Scale and Legend. Introduction, platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) Basic elements in Image interpretation. **08 Hours**

### Module - III

**Geographic Information System:** Introduction, history of GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data-spatial and non spatial, data models with advantages and disadvantages. **08 Hours**

### Module - IV

**Hyper-spectral Remote Sensing:** Hyper-spectral Imaging: Hyper spectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, N dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyper- spectral sensors, applications. High-resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications. **08 Hours**

## Module - V

Civil Engineering Applications of RS and GIS, Re-modelling of water Distribution systems using GIS, Ground water Vulnerability Modelling using GIS, Urban Development Planning using RS and GIS, Environmental Solid Waste and Degradation Assessment using RS and GIS, RS and GIS site selection for Dams, Bridges, Reservoirs. **08 Hours**

### Course Outcomes:

On completion of this course, the students are able to :

- Describe Remote sensing technology.
- Interpret GIS Maps.
- Explain about the remote sensing systems.
- Discuss application of RS and GIS for Civil engineering.

### Text books:

1. Lillesand T.M and R.W. Kiefer: "Remote sensing and image interpretation", (Chapters 1-8), 4th Edition, John Wiley and Sons, 2000, ISBN: 9780470052457.
2. Jensen J.R: "Introductory digital image processing, a remote sensing perspective", (Chapters 1-4), 2nd Edition Prentice Hall, 1996, ISBN: 9780132058407.
3. Richards J.A., and X. Jia: "Remote sensing digital image analysis: an introduction", (Chapters 1-3), 3rd Edition, Springer, 2006, ISBN: 9783540297116.
4. Mikhail E., J. Bethel, and J.C. McGlone: "Introduction to modern photogrammetry", (Chapters 5-9), Wiley, 2001, ISBN: 9780471309246.

### Reference Books:

1. Ravi P Gupta: "Remote sensing Geology", (Chapters 1-8), Springer Verilag, New York, ISBN: 9783662052839
2. Mather P.M.: "Computer processing of remotely-sensed images, an introduction", ISBN: 9781119956419.

### E-Resources:

1. http://www.set.ait.ac.th/page.php?fol=rsgisandpage=rsgis
2. http://geology.wlu.edu/harbor/geol260/lecture_notes/notes.html
3. http://www.rejinpaul.com/2014/10/vtu-civil-notes-vtu-civil-enigneering-1st-2nd-3rd-4th-5th-6th-7th-8th-semester-lecture-notes-download-load.html
4. http://www.rejinpaul.com/2013/12/civil-2nd-4th-6th-8th-semester-notes-anna-university-civil-notes.html

# Alternative Building Materials

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT453 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- Understand the concept of energy, environmental and cost effectiveness in buildings.
- Identify alternate materials and technology applied in construction.
- Understand the masonry strength concepts.
- Recognize equipments required for manufacture of alternate building materials.

## Syllabus

### Module - I

**Introduction:** Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture. **08 Hours**

### Module - II

**Alternative Building Materials:** Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block. **08 Hours**

### Module - III

**Alternative Building Technologies:** Alternative for wall construction, Ferrocement and ferroconcrete building components, Composite beam panel roofs, Masonry vaults and domes, Alternative roofing systems, Filler slabs. **08 Hours**

### Module - IV

**Structural Masonry:** Compressive strength of masonry elements, Factors affecting compressive strength, Strength of units, prisms / wallettes and walls, Effect of brick work bond on strength, Bond strength of masonry : Flexure and shear, Elastic properties of masonry materials and masonry. **08 Hours**

### Module - V

**Equipment for Production Of Alternative Materials:** Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Identify material properties (physical, structural) for most common and advanced building materials.
- Explain typical and potential applications of alternative building materials.
- Discuss relationship between material properties and structural form.
- Identify crucial problem areas in manufacture and applications of building materials.
- Evaluate the importance of experimental verification of material properties.

## Text Books:

1. Alternative building methodologies for Engineers and architects, lecture notes edited: K.S. Jagadish and B.V. Venkatarama Reddy, (Chapters 1-12) Indian Institute of science, Bangalore, published by Garland Science, Edition: 4th Edition, ISBN: 978-81-224-2037-1.
2. Arnold W. Hendry: "Structural Masonry", (Chapters 1-5), Palgrave Macmillan, 2nd Edition, ISBN: 9780333733097.

## Reference Books:

1. Relevant IS Codes.
2. Alternative building materials and technologies.
3. Proceedings of workshop on Alternative building material and technology, 19th to 20th December 2003 @ BVB Collegeof Engineering. and Tech., Hubli.

## E-Resources:

1. http://elearning.vtu.ac.in
2. www.hebel.arch.ethz.ch/alternative-building-materials
3. https://en.wikipedia.org/wiki/Alternative_natural_materials

# Advanced Concrete Technology

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT454 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

The students will be able to :

- The fundamentals of concrete structure at micro and macro levels.
- The properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.
- The various types of concrete and applications of different types of cement and concretes.

## Syllabus

### Module - I

**Chemical Admixtures and Mineral Admixture:** Introduction, Mechanism of chemical admixture, Plasticizers and Super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, new generation Super Plasticiser, Fly ash, Silica fume, GGBS, and their effect on concrete property in fresh state and hardened state. **08 Hours**

### Module - II

**Mix Design:** Factors affecting mix design, design of concrete mix by BIS method using IS10262 and current American (ACI) methods. Provisions in revised IS10262-2004. **08 Hours**

### Module - III

**Durability of Concrete:** Introduction, Permeability of concrete, chemical attack, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456-2000 requirement for durability, RMC Concrete - manufacture, transporting, placing, precautions, Methods of concreting-Pumping, under water concreting, shotcrete, High volume fly ash concrete concept, properties, typical mix. **08 Hours**

### Module - IV

**Self Compacting and Fiber Reinforced Concrete:** Introduction, materials, tests, properties, application and Typical mix, Fibers types and properties, Behavior of FRC in compression, tension including pre-cracking stage and post-cracking stages, behavior in flexure and shear, Ferro cement - materials, techniques of manufacture, properties and application. **08 Hours**

## Module - V

**Light Weight Concrete and Test on Hardened Concrete:** Materials properties and types. Typical light weight concrete mix, High density concrete and high performance concrete-materials, properties and applications, typical mix, Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Compression, tension and flexure tests. Tests on composition of hardened concrete-cement content, original w/c ratio. NDT tests concepts-Rebound hammer, pulse velocity methods. **08 Hours**

### Course Outcomes:

On completion of this course, the students are able to :

- Recognize suitable admixtures to be used in different types of concrete.
- Design different grades of concrete.
- Discuss the importance of durability of concrete.
- Explain the basic knowledge of new emerging concretes.

### Text Books:

1. Neville, A.M: "Properties Of Concrete", (Chapters 5,10,12,14), Longman Ltd., London, 5th Edition, ISBN: 978-81-317-9107-3.
2. M.S. Shetty: "Concrete Technology, M.S. Shetty", (Chapters 5, 9, 11,12), S. Chand, 2005, ISBN: 8121900034, 9788121900034.

### Reference Books:

1. M L Gambhir: "Concrete Technology", (Chapters 5,6,10,14,15,16), The McGraw-Hill Companies, 3rd Edition, ISBN: 9780070583740.
2. John Newman: "Advanced Concrete Technology Processes", (Chapters 4,6,7), Ban Seng Choo, London, 1st Edition, ISBN: 9780750651035.

### E-Resources:

1. www.atozcivilengineering.com › Education
2. www.actemirates.ae
3. www.advconcrete.com/contact-us
4. www.act-course.co.uk
5. www.labour.gov.hk/eng/public/os/D/Constructionsite.pdf

# Renewable Energy Resources

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT461 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

The students will be able to :

- To provide detailed information of the present energy scenario and the available Renewable Energy Resources.
- To get a detailed insight knowledge in basics of solar radiation geometry and various measurement techniques.
- To understand the solar energy through solar thermal devices, PV conversion and their performance analysis.
- To gain the conceptual knowledge about the various energy conversion methods such as Wind, Tidal, OTEC and Geothermal.
- To give introduction to Energy from Biomass, Hydrogen energy and their impact on environment and sustainability.

## Syllabus

### Module - I

**Introduction:** Energy source, India's production and reserves of commercial energy sources, need for non-conventional energy sources.

**Solar Radiation :** Extra-Terrestrial radiation, spectral distribution of extraterrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data.

**Measurement of Solar Radiation:** Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working. **09 Hours**

### Module - II

**Solar Radiation Geometry:** Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation), local apparent time. Apparent motion of sun, day length, numerical examples.

**Radiation Flux on a Tilted Surface:** Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations), numerical examples.

**Solar Thermal Conversion :** Collection and storage, thermal collection devices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis). **09 Hours**

## Module - III

**Performance Analysis of Liquid Flat Plate Collectors:** General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity – absorptivity product , numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers dust. **09 Hours**

## Module - IV

**Photovoltaic Conversion:** Description, principle of working and characteristics, applications.

**Wind Energy:** Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind, machines and their characteristics, horizontal and vertical axis wind mills.

**Tidal Power:** Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

**Ocean Thermal Energy Conversion:** Principle of working, Rankine cycle.

**Geothermal Energy Conversion:** Principle of working, types of geothermal station with schematic diagram. **08 Hours**

## Module - V

**Energy from Bio Mass:** Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages.

**Hydrogen Energy:** Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production bio-chemical production. **07 Hours**

## Course Outcomes:

Upon the completion of the course, the students will be able to,

- Explain the present energy scenario and the available Renewable Energy Resources.
- Describe the basics of solar radiation geometry and various measurement techniques.
- Analyze the knowledge gained in tapping the solar energy through solar thermal devices, pv conversion and their performance analysis.
- Demonstrate the various energy conversion methods such as Wind, Tidal, OTEC and Geothermal.
- Apply knowledge of Biomass and Hydrogen energy and their impact on environment and sustainability.

## Text Books:

1. G D Rai: "Non-Conventional Energy Sources", (Chapters 1-3,6-9,11), Khanna Publishers, 5th Edition, 2011, ISBN-13: 9788174090737.
2. John Twidell and Tony Weir: "Renewable Energy Resources", (Chapters 2,5,6,7,9-14), Routledge Publisher, 3rd Edition, 2015, ISBN-13: 978041558437.
3. N K Bansal, "Non-Conventional Energy Resources", (Chapters 1-3,9,10,12,13), Vikas Publishing, 2014, 1st Edition, ISBN-13: 978935978577

## Reference Books :

1. B H Khan: "Non-Conventional Energy Resources", (Chapters 4-10), Tata McGraw-Hill Pub., 2nd Edition, 2006, ISBN - 13: 9780070142763.
2. S P Sukhatme, J K Nayak: "Solar Energy", (Chapters 3,4), Tata McGraw-Hill Pub., 3rd Edition, 2008, ISBN-13: 9780070260641.

# Object Oriented Programming with C++

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT462 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Understand features of object oriented Programming concepts.
- Understand inline functions, default arguments, classes and objects.
- Understand constructor, Types of constructor and destructor and their order of execution.
- Understand operator overloading and its necessity.
- Understand the virtual function, polymorphism, exception handling.

## Syllabus

### Module - I

**Introduction:** Origin of C++, features of OOP, Sample C++ program, Different data types, operators, expressions, implicit conversion, Type cast operator and statements, arrays and strings, pointers and user defined types, reference variable, memory management operator, name space, control structure, Function, default argument, inline functions, function overloading, recursive functions. **08 Hours**

### Module - II

**Classes and Objects:** Classes, structures and classes are related. Friend functions, inline functions, Constructors, Different types of constructor, Destructors, Static data members, when constructor and destructors are executed, scope resolution operator. Nested classes, local classes, passing objects to functions, returning objects, this pointer. **08 Hours**

### Module - III

**Inheritance:** Base Class, Inheritance, Types of inheritance and protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors and inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes. **08 Hours**

### Module - IV

**Virtual functions, Polymorphism and operator over loading:** Operator over loading basics, creating a member operator function, Operator overloading using friend functions such as +, - , pre-increment, post-increment, etc., overloading <<, >>. Virtual

function, calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, pure virtual functions, Abstract classes, Using virtual functions, Early and late binding. **09 Hours**

## Module - V

**Generic function, Exception handling C++ File I/O:** Generic function, a function with two generic types, Generic sort. Exception handling fundamentals, catching class types, using multiple catch, catching all exception.<stream>, and the file classes ,opening and closing file, reading and writing text files, put(), get(), read(), write(), geline(), eof(), seekg(), seekp(), tellp(), tellg(). **07 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Apply the concepts of object oriented programming.
- Implement the concepts of classes and objects.
- Apply the concepts of inheritance to solve complex problems.
- Implement mechanism of virtual function and polymorphism.
- Develop generic function to perform different operations on different data types and implement exception handling.

## Text Book:

1. Herbert Schildt: "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2003, ISBN 13: 9780070532465.

## Reference Books:

1. Stanley B.Lippmann, Josee Lajore: "C++ Primer", 4th Edition, Pearson Education, 2005, ISBN-10: 0-321-71411-3.
2. Paul J Deitel, Harvey M Deitel: "C++ for Programmers", Pearson Education, 2009, ISBN-10: 0137059663.

## E-References:

1. http://www.tutorialspoint.com/cplusplus/cpp_tutorial.pdf
2. http://www.ddegjust.ac.in/studymaterial/mca-3/ms-17.pdf

# Management Information Systems

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT463 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

The students will be able to :

- Effectively use and administrate information systems in different business applications.
- Understand problem solving techniques to model information system solutions for business problems.
- Understand the business and professional responsibilities related to the use of information system in organizations.

## Syllabus

### Module - I

**Foundations of information systems in business:** Introduction to Information Systems in Business: Why study Information Systems? What you need to know, A global Information society, Success and Failure with IT, Why Businesses need Information Technology. Fundamentals of Information Systems: Fundamental Information System concepts: System concepts, Components of an Information System, Information System Resources, Information System activities, Overview of Information Systems: The expanding Role of Information Systems, Operations support Systems, Management support Systems, Other classifications of Information Systems. **08 Hours**

### Module - II

**Solving Business Problems with Information Systems:** A Systems Approach to problem Solving: The Systems approach, Defining problems and opportunities, Developing alternative solutions, Evaluating Alternative solutions, Selecting the best solution, Using the Systems approach. Developing Information System Solutions: The system development cycle, Starting the Systems Development process, Systems Analysis, Systems Design, Prototyping, Implementing a new Information System, Maintenance of Information System, Computer Aided Systems Engineering, End user development.

**Business applications – I**

**The Internet and Electronic Commerce: The Internet and Business:** Introduction, Business use of the Internet, Interactive marketing, Business value of the Internet, Customer value and the Internet. Fundamentals of Electronic Commerce:

Introduction, Foundations and applications of e -commerce, Business to Consumer and Business to Business commerce, Electronic payments and security. **08 Hours**

## Module - III

**Intranets, Extranets, and Enterprise Collaboration:** Intranets and Extranets in Business: Business Value, Applications and Technologies for Intranets, Role of Extranets, Enterprise Collaboration Systems: Enterprise Collaboration, GroupWare, Electronic communication and Conferencing tools, collaborative work management tools. Information Systems for Business Operations: Business Information Systems: Cross Functional Marketing, Manufacturing, Human Resources, Accounting and Financial Information Systems. **08 Hours**

## Module - IV

**Transaction Processing Systems:** Transaction Processing, Data entry, Batch and Real-time processing, Database maintenance, Document and Report generation, Inquiry processing.

**Business applications -II**

**Information Systems for Strategic Advantage:** Introduction, Competitive strategy, Strategic Roles for Information System, Breaking Business Barriers, Value chain and strategic Information System, Strategic Applications and Issues in information Technology, Reengineering Business process, Improving Business quality, Becoming an agile competitor. Creating a virtual company, Building the knowledge-creating company, Using the Internet strategically. **08 Hours**

## Module - V

**Managing information technology:** Enterprise and global Management: Managing Information Resources and Technologies: Information Technology Architecture, Managers and Information Technology, Organizations and Information Technology, Information Resource Management, Strategic Management Operational Management, Resource Management, Technology Management, Global Information

**Technology Management:** The International Dimension, Global IT Management, Cultural, Political and Geo -Economic challenges, The global company, Global Business and IT strategies, Global Business and IT applications, Global IT Platforms, Global data Issue, Global Systems development, You and Global IT Management. Planning.

**Implementing change :** Planning for Business change with IT: Organizational planning, Information System planning Methodologies, The scenario approach, Planning for competitive advantage, Critical success factors, Business Systems Planning, Computer -Aided Planning tools, implementing business change. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Describe the roles and functionalities of information system.
- Analyze types of solutions for business and its applications.
- Analyze the usage of Intranet and Extranet in business applications.
- Describe database management and competitive strategic approach of information systems in business applications.
- Describe various approaches in managing information technology.

## Text Book:

1. James O'brien, George Marakas: "Management Information System", 10th Edition, Mcgraw-Hill Education, 2010, ISBN-13: 978-0-07-3376813, ISBN: 0-07-337681-7.

## Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon: "Management Information System, Managing the Digital Firm", 11th Edition, Pearson Education, 2006.
2. Steven Alter: "Information Systems The Foundation of E-Business", 4th Edition, Pearson Education, 2002.

## E-Resources:

1. https://books.google.co.in/books/about/Management_Information_System.html.
2. http://www.pearsoned.co.uk/bookshop.

# Smart Materials

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT464 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

The students will be able to :

- Understand the characteristics of composites and smart materials in the product design process.
- Know the types of sensing and actuation devices.
- Gain the knowledge of optics and electromagnetic technology.
- Study the importance of different control systems.
- Realize and understand the principles of vibration and modal analysis.

## Syllabus

### Module - I

**Introduction:** Characteristics of composites and ceramics materials, Dynamics and controls, concepts, Electro-magnetic materials and shape memory alloys-processing and characteristics .

**Control Design:** Design of shape memory alloys, Types of MR fluids, Characteristics and application, principles of MR fluid value designs, Magnetic circuit design, MR Dampers, Design issues. **09 Hours**

### Module - II

**Sensing And Actuation:** Principles of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications, their compatibility writer, conventional and advanced materials, signal processing, principles and characterization. **08 Hours**

### Module - III

**Structures:** Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects.

**Optics And Electromagnetic:** Principles of optical fiber technology, characteristics of active and adaptive optical system and components, design and manufacturing principles. **09 Hours**

## Module - IV

**Controls:** Principles of structural acoustic control, distributed, analog and digital feed back controls, Dimensional implications for structural control. **08 Hours**

## Module - V

**Principles of Vibration And Modal Analysis :** PZT Actuators, MEMS, Magnetic shape Memory Alloys, Characteristics and Applications.

**Information Processing:** Neural Network, Data Processing, Data Visualisation and Reliability – Principles and Application domains. **08 Hours**

## Course Outcomes:

On completion of this course, the students are able to :

- Explain the characteristics of composites and smart materials in the product design process.
- Identify various types of sensing and actuation devices.
- Analyze the optics and design structures using smart materials.
- Demonstrate the working principles of different control systems.
- Describe the principles of vibration and modal analysis.

## Text Books:

1. A V Srinivasan, D Michael Mcfarland: "Smart Structures: Analysis and Design", (Chapters 2-5,7,8), Cambridge University Press, 1st Edition, 2001, ISBN-13: 9780521659772.
2. M V Gandhi, B S Thomson: "Smart Materials and Structures", (Chapters 13-75), Chapman and Hall Pub., 1st Edition, 1992, ISBN-13: 9780412370106.

## Reference Books :

1. Eric Udd: "Fiber Optic Sensors: An introduction for Engineers and Scientists", (Chapters 1-16), John Wiley and Sons Pub., 2nd Edition, 2011, ISBN-13: 9780470126844.
2. G P Gibss: "Adaptive Structres", John Wiles and Sons, New York, 1998.
3. Banks HT, RC Smith, Y Wang, Massow S A: "Smart Materials and Structures", Paris, 1996.

# Concrete Laboratory

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL47 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Impart the basic knowledge of Concrete and its components.
- Prepare the students to effectively link theory with practice.
- Prepare the students to analyze data using experiments and to apply.
- Have an exposure on basic construction material testing equipments.
- Prepare the students to solve problems on concrete mix design.

## Syllabus

### Tests on Cement

1. Standard consistency.
2. Initial and Final setting time of cement.
3. Compressive strength of cement.
4. Fineness of cement.
5. Specific gravity of cement.
6. Soundness of cement.

### Tests on Fresh Concrete

1. Workability of Concrete by Slump cone method.
2. Workability of Concrete by Compaction factor method.
3. Workability of Concrete by Vee-Bee Consistometer.

### Tests on Hardened Concrete

1. Compressive strength of Concrete.
2. Split tensile strength of Concrete.
3. Flexural strength of Concrete.

### Tests on Aggregates

1. Bulk density of sand.
2. Fineness Modulus of Coarse and Fine aggregates.
3. Water absorption of Coarse and Fine aggregates.
4. Specific gravity of Coarse and Fine aggregates.

## Concrete Mix Design

1. Concrete Mix Design as per IS:10262-2009.

## Bricks

1. Water absorption test on Bricks.
2. Compressive strength of Bricks.
3. Bonds in Brick Masonry.

## Course Outcomes:

On completion of this course, the students are able to :

- Identify the relevant physical properties pertaining to the construction materials.
- Identify the suitability of materials for the construction works.
- Recommend the relevant IS testing procedure to be carried out to ascertain the quality of building materials.
- Design a concrete mix as per IS:10262-2009.
- Recognize the construction technique to be followed in brick and stone masonry.

## Text Books:

1. Dr. M.L. Gambhir: "Concrete Manual", Dhanpat Rai and Sons, Delhi, 4th Edition, ISBN: 1234567144619.
2. TTTI Chandigarh: "Concrete Lab Manual", Indian Society of Technical Education, 6th Edition, ISBN -13: 9788122407570.
3. M.S.Shetty: "Concrete Technology, Theory and Practice", 23rd Edition, S. Chand and Company, ISBN 10: 8121900034 / ISBN 13: 9788121900034.

## E-Resources:

1. http://elearning.vtu.ac.in
2. www.sginstitute.in/Downloads/Civil.../Manual_ConcreteTech
3. https://www.nbu.edu.sa/...Labs-Manual/02-%20CRT_Lab_safety_Manual
4. https://www.concrete.org/certification/certificationprograms.aspx

# Surveying Practice-II

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL48 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

The students will be able to :

- Impart the knowledge of Theodolite.
- Expose the students to different curves and methods of setting them in field.
- Study the use of total station and its applications in various fields of surveying.
- Study the basic concepts of GPS and its applications.

## Syllabus

### Exercise – 1

Measurement of horizontal angles with method of repetition and reiteration using theodolite, Measurement of vertical angles using theodolite.

### Exercise – 2

To set out simple curves using linear methods – perpendicular offsets from long chord and offsets from chords produced.

### Exercise – 3

To set out simple curves using Rankine's deflection angles method.

### Exercise – 4

To set out compound curve with angular methods with using theodolite only.

### Exercise – 5

Exposure to use of total Station.

### Exercise – 6

Traversing by total station.

### Exercise – 7

Longitudinal sections, Cross section and Block levelling by total station.

### Exercise – 8

Usages of relevant software for preparation of the contour drawings.

## Exercise – 9

Co-ordinates and distance measurement with GPS.

### Course Outcomes:

On completion of this course, the students are able to :

- Recognize the importance of theodolite in the field of surveying.
- Construct the simple curves using different linear methods.
- Illustrate the Concepts and Principles in setting out simple and compound curves.
- Illustrate the use of Total Station in the different fields of surveying.
- Compute the co-ordinates and to measure distances using GPS.

### Text Books:

1. Dr B C Punmia: "Surveying Volume I", (Chapters 1-4,6,7,9-13,16,18,22), Lakshmi Publications, Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.
2. Dr B C Punmia: "Surveying Volume II", (Chapters 1-4,6,7,15), Lakshmi Publications Pvt, Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.

### Reference Books:

1. C Venkatramaiah: "Text Book of Surveying", (Chapters 1-5,7-12), Universities Press (India) Pvt. Ltd., 5th Edition, 1996.
2. S.K. Roy: "Fundamentals of Surveying", (Chapters 1,3,19), Prentice-Hall of India Pvt. Limited, 2004, 2nd Edition, ISBN: 81-20-312-60-0.

### E-Resources:

1. http://lib.uniten.edu.my/libsite/index.php?option=com_joomdandview=itemandlayout=detailandtypeid=2andid=202andItemid=790
2. http://ascelibrary.org/journal/jsued2
3. www.survivorlibrary.com/engineers_surveying_instruments_1892.pdf

# Soft Skills Development

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVH49 | 0:2:0:0 | 1 | CIE:50 SEE:50 | 2 Hours | HSS |

## Course Objectives:

The students will be able to :

- Improve the communication skills.
- Develop the art of presentation and writing effectively.
- Enhance the technical knowledge.

## Syllabus

To improve the communication and presentation skills, every student has to give a seminar on technical topics assigned by the supervisors. Each course coordinator/ faculty members will be assigned with few students to guide and monitor the presentation. The presentation shall be for 15 minutes. A brief report on the seminar has to be submitted by the student to the concerned department after completion of the seminar. The report shall be signed by the supervisor and the Head of the concerned department.

The objective of the seminar is to introduce students to the major constituent of technology that is concerned with critically reading, understanding, summarizing, explaining and presenting existing technical topics. Students have to refer one or more topics that are assigned to them by their supervisors. The idea behind the seminar system is to familiarize student more extensively with the methodology of their chosen subject, allow them to develop presentation skills, and also interact with example of practical problems.

## Course Outcomes:

On completion of this course, the students are able to :

1. Overcome stage fear and answer questions from audience.
2. Communicate confidently and fluently.
3. Comprehend and prepare reports effectively.

# Fifth Semester B.E. – Syllabus

# Transportation Engineering (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI51 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Understand the importance and characteristics of road transport and various committee.
- Understand the recommendations, various road patterns and road development programmes in India.
- Analyze requirements of Ideal alignment and various geometrical design factors.
- Gain knowledge on Pavement materials and its properties.
- Gain knowledge on Pavement design as per IRC and details of pavement.
- Get the importance of Highway Drainage system and Highway Economics.

## Syllabus

### Module – I

**Principles of Transportation Engineering:** Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport, Jayakar committee recommendations and implementation – Central Road Fund, Indian Roads Congress.

**Highway Development and Planning:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, Present scenario of road development in India (NHDP and PMGSY) and in Karnataka (KSHIP andKRDCL), Road development plan - vision 2021.

**08 Hours**

### Module – II

**Highway Alignment and Surveys:** Ideal Alignment, Factors affecting the alignment, Engineering surveys- Map study, Reconnaissance, Preliminary and Final location and detailed survey, Reports and drawings for new and re-aligned projects.

**Highway Geometric Design-I:** Importance, Terrain classification, Design speed, Factors affecting geometric design, Cross sectional elements; Camber- width of pavement-Shoulders, Width of formation- Right of way, Typical cross-sections.

**08 Hours**

## Module – III

**Highway Geometric Design-II:** Sight Distance-Restrictions to sight distance- Stopping sight distance-Overtaking sight distance- overtaking zones- Examples on SSD and OSD- Sight distance at intersections, Horizontal alignment-Radius of Curve- Super elevation – Extra widening-Transition curve and its length, setback distance – Examples, Vertical alignment-Gradient-summit and valley curves with examples.

**08 Hours**

## Module – IV

**Pavement Materials and Design Sub grade soil:** Desirable properties - HRB soil classification-determination of CBR and modulus of sub grade reaction - Examples on CBR and Modulus of sub grade reaction, **Aggregates-** Desirable properties and list of tests, **Bituminous materials**- Explanation on Tar, bitumen, List of tests on bituminous materials. Pavement types, component parts of flexible and rigid pavements and their functions, design factors, ESWL and its determination - Examples, Flexible pavement-Design of flexible pavements as per IRC:37-2001 - Examples, Rigid pavement- Westergaard's equations for load and temperature stresses - Examples.

**08 Hours**

## Module – V

**Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials.

**Highway Economics:** Highway user benefits, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples. **08 Hours**

## List of Highway Material Testing Lab Experiments

| Sl. No. | Name of the Experiment |
|---|---|
| | **Test on Aggregates** |
| 1 | Aggregate crushing value |
| 2 | Aggregate abrasion value (Los Angels Abrasion Test) |
| 3 | Aggregate Impact value |
| 4 | Shape tests on aggregates (Flaky, elongation) |
| | **Test on bituminous materials and mixes** |
| 5 | Specific gravity of bitumen |
| 6 | Penetration test on bitumen |
| 7 | Ductility test on bitumen |
| 8 | Viscosity test on bitumen |
| 9 | Softening point test on bitumen |
| 10 | Flash and fire point test on bitumen |
| 11 | Marshall Stability tests on bituminous |

## Course Outcomes:

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

- Study in detail about of road transport that includes characteristics features, various committee.
- Recognize different road patterns and road development programmes in India.
- Analyze factors influencing road alignment, different types of road surveys and factors influencing geometric design.
- Study Horizontal and vertical alignment, Pavement materials and its properties.
- Design Pavement as per IRC and details of pavement.
- Know the importance of Highway Drainage system and Highway Economics.

## Text Books:

1. S.K. Khanna, Dr. C.E.G Justo, Dr. A. Veeraragavan: "Highway Engineering", (Chapters 1-4, 6, 7, 11, 14), Revised 10th Edition, Nem chand and Bros, Roorkee, 2014, ISBN: 9788185240725.
2. Dr. L.R. Kadiyali, Dr. N.B. Lal, "Principles of Highway Engineering", (Chapters 1, 2, 6, 16, 18, 19, 20, 22), Khanna Publishers, New Delhi -6, ISBN: 9788174091659.

## Reference Books:

1. IRC Codes – IRC:37-2001, IRC:58-2002.
2. Specifications for Roads and Bridges- MoRT & H Specifications.
3. C. Jotin Khisty, B. Kent Lal, "Transportation Engineering", PHI Learning Pvt. Ltd., New Delhi.
4. James H Banks, "Transportation Engineering", McGraw Hill Pub., New Delhi.

## E-Resources:

1. https://www.fhwa.dot.gov/environment/publications/flexibility/ch01.cfm
2. https://www.railelectrica.com/traction-mechanics/train-grade-curve-and-acceleration-resistance-2/
3. http://nptel.ac.in/courses/105104098/TransportationII/lecture6/7slide.htm/
4. http://www.aboutcivil.org/highway-drainage-design-guidelines-structures.html
5. http://nptel.ac.in/courses/105104098/45

# Structural Analysis – II

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT52 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Analyze indeterminate structures by deflection method.
- Analyze the frames by moment distribution method.
- Understand the concepts of matrix method.
- Analyze the static indeterminate structures by matrix method.
- Understand the concepts of influence line diagrams and principles of dynamics.

## Syllabus

### Module – I

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

### Module – II

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

### Module – III

**Sway Analysis:** Analysis of rigid jointed plane frames (sway, members assumed to be axially rigid and kinematic redundancy ≤ 3) by slope deflection and moment distribution methods. **08 Hours**

### Module – IV

**Kanis Methods:** Introduction, Basic Concept, Analysis of Continuous beams and Analysis of rigid jointed non-sway plane frames.

**Stiffness Matrix Method of Analysis:** Introduction, Development of stiffness matrix for plane truss element and axially rigid plane framed structural elements with kinematic indeterminacy ≤3. **08 Hours**

### Module-V

**Rolling Load and Influence Lines:** Rolling load analysis for simply supported beams for several point loads and UDL, Influence line diagram for reaction, SF and BM at a given section for the cases mentioned above. **08 Hours**

## Course Outcomes:

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

- Solve beams and frames by slope deflection method
- Solve the problems connected with analysis of various structural components
- Solve the given frames by suitable method.
- Evaluate the continuous beams by suitable methods.
- Evaluate rolling load and influence line diagram for S.S beams.

## Text Books:

1. S S Bhavikatti: "Structural Analysis - Vol. II", (Chapters 1, 3-6), Vikas Publishing House, 4th Edition, 2009, ISBN: 9789325968806, 9325968800.
2. S Ramamrutham and R Narayan: "Theory of Structures", (Chapters 9-12,14), Dhanpat Rai Publishing Company Private Limited, New Delhi, 9th Edition, 2014, ISBN: 978-9384378103.

## Reference Books:

1. Reddy C. S: "Basic Structural Analysis", (Chapters 11-13,18), Tata McGraw Hill, New Delhi, 3rd Edition, 2010, ISBN: 9780070702769.
2. G.S. Pandit and R. Gupta: "Theory of Structures" Vol. 2, (Chapters 1-5), Tata McGraw Hill Publication Company Ltd., 1st Edition, ISBN: 9780074634981, 0074634984.

## E-Resources:

1. http://elearning.vtu.ac.in/elcmys/13/ENotes/ECEEM/GR.pdf
2. http://elearning.vtu.ac.in/elcmys/e-con/Stru_Ana/ch5/html/0004.htm
3. http://elearning.vtu.ac.in/elcmys/P2/CV42/Chapter_05/html/0004.htm
4. http://elearning.vtu.ac.in/elcmys/StruAna.htm

# Design of RCC Structural Elements (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI53 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Fundamentals of concrete and steel reinforcement used for reinforced concrete design.
- Design methodologies of various structural components for different load conditions.

## Syllabus

### Module – I

**Introduction:** Objectives of the Design of Reinforced Concrete Structures, Method of Design, Design Loads, Properties of Steel, Principles of limit states, Partial safety factors, Characteristic and design loads, Characteristic and design strength, Stress block parameters for limit state of collapse by flexure, General Specification for flexure design of beams-practical requirements, size of beam, cover to reinforcement-spacing of bars Analysis examples of singly reinforced, doubly reinforced, flanged sections, shear strength and development length. **08 Hours**

### Module – II

**Design of Beams:** Design procedures for critical sections for moment and shear, Slenderness limits for beams to ensure lateral stability, Design examples for singly reinforced, doubly reinforced Simply supported beams and Cantilever beams for rectangular and flanged sections. **08 Hours**

### Module – III

**Design of Slabs:** General consideration of design of slabs, Rectangular slabs spanning in one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of simply supported, cantilever and continuous slabs as per IS: 456 – 2000. **08 Hours**

### Module – IV

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

**Design of Stair cases:** General features; types of stair case, Design of Dog legged and Open well stair cases. **08 Hours**

## Module – V

**Design of Footings:** Introduction, Design of isolated rectangular footing for axial load. **Flexure and Serviceability Limit States:** General aspects of serviceability, Deflection limits in IS: 456 – 2000, Calculation of deflections and crack width. **08 Hours**

### List of Experiments using Auto Cadd Software

| Sl. No. | Name of the Experiment |
|---|---|
| 1 | Drawing of Singly and Doubly reinforced beams. |
| 2 | Drawing of one way, one way continuous and two way Slabs. |
| 3 | Drawing of columns. |
| 4 | Drawing of dog legged and open Well stair case. |
| 5 | Drawing of footings. |

### Course Outcomes:

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

- Recognize the design philosophies of reinforced concrete structures.
- Apply the principles, procedures and current code requirements to the analysis and design of reinforced concrete beams using limit state method.
- Design Reinforced Concrete slabs.
- Analyze and Design the Reinforced Concrete Columns and stair cases.
- Design structures for serviceability and footings.

### Text Books:

1. M.L.Gambhir: “Fundamentals of Reinforced concrete Design”, (Chapters 1,2,5-7), PHI Learning Private Limited, 2008-2009, ISBN: 978-8120330481.
2. S. S. Bhavikatti: “Design of RCC Structural Elements Vol-I”, (Chapters 1-6, 8), New Age International Publications, New Delhi, ISBN: 978-8122416930.

### Reference Books:

1. P.C. Varghese: “Limit State Design of Reinforced concrete”, (Chapters 1,3,6,7,9), PHI Learning Private Limited 2008-2009, ISBN: 978-8120320390.
2. S.N.Shinha: “Reinforced concrete Design” TMH Education Private Limited, ISBN: 978-9351342472.
3. Indian Standard Codes: IS: 456-2000 and SP-16.

### E-Resources:

1. http://nptel.ac.in/courses/105105105/6
2. https://constructionduniya.blogspot.in/2011/12/basic-concepts-for-civil-engineers-for_12.html
3. http://nptel.ac.in/courses/105105105/14

# Construction Industry Practice-I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT541 | 3:0:0:0 | 3 | CIE:50 EE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Understand Different type on Loads on Structures and their impact on structural elements.
- Learn Concrete applications in Civil Engineering.
- Learn Construction Methodologies.
- Learn Masonry structures Specification/ Tendering and Contract Documentation.

## Syllabus

### Module – I

**Scope of Civil Engineering** **08 Hours**

### Module – II

**Different type of Loads of Structures and their impact on structural elements:** Relevance of Codes - Indian and International Code rent type of buildings and occupancies Relevance of Structural Properties - Bending Moment, Shear Force, Torsion. **08 Hours**

### Module – III

Concrete applications in Civil Engineering (Types of Concrete / Grade / Strength / Performance / Heat resistance/ Concrete Blocks/ Decorative Concrete / Transparent Concrete/ Permeable Concrete). **08 Hours**

### Module – IV

Construction Methodologies / Workmanship / Standards for various works / Tools / Plants / Construction machinery. **08 Hours**

### Module – V

Masonry structures, Basic Building Water supply / Plumbing Services BOQ / Data Sheet / Specification / Tendering and Contract Documentation. **08 Hours**

## Course Outcomes:

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

- Distinguish different type of Loads of Structures and their impact on structural elements.
- Execute Concrete applications in civil engineering.
- Summarize Construction Methodologies.
- Summarize Masonry structures Specification/ Tendering and Contract Documentations. .

# Advanced Fluid Mechanics

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT542 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Learn the principles of dimensional analysis to design hydraulic models and Design of various models.
- Understand the flow physics of different fluids.
- Learn the aspects of boundary layer conditions and its application.
- Learn the basics of Impulse-Momentum principle.

## Syllabus

### Module – I

**Dimensional Analysis:** Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Buckingham π theorem, dimensional analysis, choice of variables, examples on various applications. (Theory and Problems) **08 Hours**

### Module – II

**Model Analysis:** Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model. (Theory and Problems). **08 Hours**

### Module – III

**Viscous Flow:** Introduction, Flow of viscous fluid through circular pipe and parallel plates, power adsorbed in viscous flow, loss head due to friction in viscous flow, Method of determining coefficient of viscosity. (Theory and problems). **08 Hours**

### Module – IV

**Boundary Layer Flow:** Introduction, drag force on a flat plate due to boundary layer, turbulent boundary layer on flat plate, Separation of boundary layer, method of preventing separation of a boundary layer. (Theory and problems). **08 Hours**

### Module – V

**Impact of Jet:** Introduction, Impulse-Momentum equation. Direct impact of a jet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes (theory and Problems). **08 Hours**

## Course Outcomes:

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

- Apply the principles of dimensional analysis and similitude to solve engineering problems and use dimensionless parameters.
- Analyze models and compute the parametric values in prototype by analyzing the corresponding model parameters
- Analyze and apply viscous flow principle for engineering problems.
- Apply the concept of boundary layer condition for analyzing engineering problems.
- Apply the principles of Impulse-Momentum for engineering problems.

## Text books:

1. P N Modi, S M Seth: "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th Edition, 2015, Standard Book House, New Delhi, ISBN: 978-81-894-0126-9.
2. R.K. Bansal: "A Text book of Fluid Mechanics and Hydraulic Machines", 9th Edition, 2014, Laxmi Publications, New Delhi, ISBN: 978-81-318-0815-3.
3. S K SOM and G Biswas: "Introduction to Fluid Mechanics and Fluid Machines", 2013, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, ISBN: 978-00713-2919-4.

## Reference books:

1. K Subramanya: "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd., ISBN: 978-00-706-9980-9.
2. Mohd. Kaleem Khan: "Fluid Mechanics and Machinery", 2015, Oxford University Press, ISBN: 978-01-994-5677-2.
3. C.S.P. Ojha, R. Berndtsson, P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Publication, 2010, ISBN: 978-01-956-9963-0.
4. J.B. Evett, C. Liu: "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company - 2009. ISBN: 978-00-702-3316-4.

# Traffic Engineering

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT543 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Scope of traffic engineering and traffic characteristics.
- Various traffic engineering studies.
- Interpretation of the traffic study and traffic flow theory.
- Intersection design and Rotary intersection.
- Traffic regulation and control and ITS.

## Syllabus

### Module – I

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

**Traffic Characteristics:** Road user characteristics, Vehicular characteristics – static and dynamic characteristics, Power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Problems on above. **08 Hours**

### Module – II

**Traffic Studies and Interpretation** – Types, Objectives, Data collection, analysis and interpretation of results of classified traffic studies. Spot speed, speed and delay, origin and destination, Parking studies, Accident- causes, analysis of individual accidents, measures to reduce accident. Problems on above. **08 Hours**

### Module – III

**Traffic Flow Characteristics:** Traffic flow variables, speed – flow – density relationship, PCU values, correlation and regression analysis (linear only) – Queuing theory, Poisson's distribution and Normal Distribution application to traffic engineering and relevant problems on above. Traffic Forecast and Simulation technique. **08 Hours**

### Module – IV

**Intersection Design:** Principle At grade and Grade separated junctions – Types – channelization –Features of channelizing Island – median opening – Gap in median at junction.

**Rotary Intersection:** Elements – Advantages – Disadvantages – Design guide lines – Three legged inter section – Diamond inter change – Half clover leaf – Clover leaf- Advantages- Disadvantages only. **08 Hours**

### Module – V

**Traffic Regulation and Control:** Driver, vehicle and road controls – Traffic regulations – Traffic markings, Traffic signs, Traffic signals – Vehicle actuated and synchronized signals – Signals co-ordination. Webster's method of signal design, IRC method – Street lighting, Road side furniture's. Relevant problems on above.

**Intelligent Transport System:** Definition, Necessities, Application in the present traffic scenario. **08 Hours**

## Course Outcomes:

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

- Know the objective and scope of traffic engineering and traffic characteristics.
- Interpret the traffic study and traffic flow theory.
- Conduct traffic studies and analyze traffic data
- Design traffic signal systems .
- Determine the capacity of highways.
- Recognize traffic regulation and control and ITS.

**Text Books**:

1. L.R. Kadiyali: "Traffic Engineering and Transport Planning", Khanna Publishers, (Chapters, 1-6,8-11,13-17), ISBN-10: 817409220X,ISBN-13: 978-8174092205.
2. Khanna, Justo: "Highway Engineering", Nemchand and Bros, Roorkee, (Chapter 5), ISBN: 978-81-85240-80-0.

## Reference Books:

1. Salter RJ and Hounsell NB: "Highway, Traffic Analysis and Design"- Macmillan Press Ltd., London, (Chapters 1-4), ISBN: 9780333609033.
2. Matson T M, Smith W S, Hurd F W: "Traffic Engineering, McGraw Hill Book Co, NY, USA, ISBN 10: 0071761136 ISBN 13: 9780071761130.
3. Drew D R," Traffic Flow Theory and Control", McGraw Hill Book Co, NY, USA, ISBN: 978-3-642-02604-1.
4. Wohl, Martin: "Traffic System Analysis of Engineers and Planners", Mcgraw Hill Book Co., New York, USA, ISBN-10: 0070712743, ISBN-13: 9780070712744.
5. Pignataro: " Traffic Engineering", John wiley and sons, ISBN: 978-1-118-76230-1
6. Nicholas J Garber, Lester A Hoel: "Traffic and Highway Engineering"- Third Edition, Bill Stenquist, ISBN: 0-534-38743-8.
7. IRC: SP:41-1994, IRC SP:31-1992, IRC 43-1994, Indian Roads Congress.
8. MORTH: "Type Designs for Intersections on National Highways", Indian Roads Congress.
9. MORTH: "Manual for Road Safety in Road Design", Indian Roads Congress.

## E-Resources:

1. https://en.wikipedia.org/wiki/Traffic_engineering(transportation)
2. http://www.faadooengineers.com/threads/7094-Traffic-Engineering-Ebooks-notes-pdf-ppt-download
3. http://nptel.ac.in/downloads/105101008/
4. http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4114883

# Advanced Surveying

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT551 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Introduction to advanced surveying techniques.
- Basic understanding of linear and angular measurements.
- Give an idea about surveying techniques.

## Syllabus

### Module – I

**GPS – Principles:** EDM – Principle, sources and error, GPS – Principles, Errors, Differential GPS, Instruments and Setting out of tunnel, bridge. **08 Hours**

### Module – II

**Map Projection:** Fundamental properties of Map projection – Classification of Map projection- Principles of selecting map projection, Surveying and map projection. **08 Hours**

### Module – III

**Basics of Photogrammetry:** Principles of photography – instruments – photographic measurements – vertical photographs – stereoscopic viewing and parallax. **08 Hours**

### Module – IV

**Types of Photogrammetry and Interpretation:** Photomaps and Mosaics – Tilted photographs – Oblique and panoramic photographs – Terrestrial photogrammetry –around controls – photographic interpretation. **08 Hours**

### Module – V

**Astronomical Surveying:** Field Astronomy, measurement of time, determination of Azimuth, Latitude and longitude. **08 Hours**

## Course Outcomes:

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

- Applying the principles of surveying and leveling in GPS.
- Prepare contouring and topographic maps and Map projections.
- Managing and controlling area to be surveyed effectively to minimize the error by Photogrammetric principles.
- Applying principles of governing error in measurement.
- Know the electronic principles on distance measurement and basic knowledge on Hydrographic surveying.

## Text Books:

1. Bannister, A., Raymond, S., Baker, R.: "Surveying", Pearson Education, 2006, ISBN: 978-0582302495.
2. Kavanagh, Barry F: "Surveying: Principles and Applications", Vol-2, 8th Edition, 2009, Prentice Hall, ISBN: 978-0132365123.
3. Lille Sand: "Remote Sensing and Image Interpretation", 7th Edition, 2015, John Wiley and Sons, ISBN: 978-1-119-12846-5.
4. Paul R Wolf: "Elements of Photogrammetry with application of GIS", McGraw International, 4th Edition, 2014, ISBN: 978-0071761123.

## Reference Books:

1. Chandra, A.M.: "Higher Surveying", New Age International Publishers, 2002, ISBN: 9788122438123.
2. Punmia P.C.: "Surveying", Volume 3, Fifteenth Edition, Laxmi publications, 2004, ISBN: 81-7008-825-9.
3. Peter A Burrough: "Principles of GIS", 3rd Edition, Oxford Publications, 2015, ISBN: 9780198742845.
4. Christopher Jones: "GIS and Computer Cartography", Longman Publications, 2007, ISBN: 9780582044395.
5. M Anji Reddy: "Remote Sensing and GIS", BS publication, 2008, ISBN: 978-81-7800-135-7.
6. Arthur Bannister, Stanley Raymond and Raymond Baker: "Surveying", Vol.2, 7th Edition, Pearson Education, 1998, ISBN: 978-0582302495.

## E-Resources:

1. https://www.indiabix.com/civil-engineering/advanced-surveying/
2. https://www.safaribooksonline.com/library/advanced surveying/9789332501430/
3. www.asicivilsurvey.com/
4. https://www.slideshare.net/suryaom/advance-surveying-equipments

# Construction Management and Engineering Economics

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT552 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Understand the fundamentals of construction andproject management.
- Learn the fundamentals of Resource management.
- Study the concepts of Construction Economics and Finance.
- Learn financial management and construction accounting.

## Syllabus

### Module – I

**Introduction:** Construction Team and functions of a construction manager. Project Organization, Types, structure and practices. Stages of construction project, Delays. Job layout, Construction schedules - Preparation, uses and types of construction schedule. **08 Hours**

### Module – II

**Project management:** Project Planning, Scheduling, Monitoring and Updating. Work Breakdown Structure, Introduction to CPM and its applications, Network fundamentals, Numerical on Fulkerson's rule. Introduction to PERT and its uses and importance, Numerical on Time estimates. **08 Hours**

### Module – III

**Resources management:** Equipment-Selection, planning and financing. Equipment management and maintenance, Owning and operation costs. Materials management – Importance, objectives and uses. Functions of materials management department and stores management. **08 Hours**

### Module – IV

**Engineering economics:** Basic principles, Time value of money, Nominal and Effective Interest, Discounted cash flow, Cash flow diagrams Equivalence – Single payment Compound amount factor, Uniform annual series payments – Derivations and problems. **08 Hours**

### Module – V

**Financial management**–Working capital management, Sources of finance, Long term and short term Finance Construction accounting – Basic concepts and principles, Income statement, Financial statements – Profit and Loss, balance sheets Taxation Inflation and Depreciation – methods of depreciation. **08 Hours**

## Course Outcomes:

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

- Recognise the nature of construction industry and the importance of management.
- Formulate project management principles to solve problems on construction network and time estimates.
- Manage the resources efficiently in construction.
- Apply the concepts of economics and finance in constructions.
- Manage finance and accounts in construction.

## Text Books:

1. Chitkara K K: "Construction Project Management", 10th Reprint, (Chapters 1-4,8,9), Tata McGraw Hill, 2006, ISBN-13: 978-9339205447.
2. Srinath L.S: "PERT and CPM", 3rd Edition, (Chapters 1-7), East West Press Pvt. Ltd., New Delhi, 2001, ISBN-13: 978-8185336206.
3. Courtland A. Collier and William B. Ledbetter, "Engineering Economics and Cost Analysis", (Chapters 1-4,7-12,14,15), Harper and Row, 2005, ISBN-13: 9780673983947.

## Reference Books:

1. Peurifoy. R L: "Construction Planning, Equipment and Methods", 6th Edition, (Chapters 1,2), McGraw Hill, 2001, ISBN 13: 9780072321760.
2. Harris F and McCaffer R.: "Modern Construction Management", 7th Edition, (Chapters 4,6,7), BSP Professional Books, 2013, ISBN-13: 978-0470672174.

## E-Resources:

1. nptel.ac.in/courses/105103023/
2. http://www2.aku.edu.tr/~icaga/kitaplar/fundamentals-of-construction-management.pdf
3. https://iimtstudies.files.wordpress.com/2014/03/finance_and_eco.pdf
4. https://www.openstaxcollege.org/files/textbook_version/low_res_pdf/21/principles-of-economics-LR.pdf

# Green Buildings

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT561 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Understand the global and local environmental problems connected to the built environment.
- Understand how ecosystem can be enhanced and improved in building projects.
- Understand about life cycle assessment of building materials and products.
- Understand the importance and utilisation of solar energy in building construction.
- Explore the best use of non-renewable energy with minimal intrusion to the environments and of renewable energy to sustain the advancement of civilization.
- Become familiar with water consumption and water quality assessment.

## Syllabus

### Module – I

**Introduction:** Environmental implications of buildings energy, carbon emissions, High performance green buildings; Building materials: sources, methods of production and environmental implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings**.** **08 Hours**

### Module – II

**Implications of Building Technologies Embodied Energy of Buildings:** Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings. Methods and tools for building assessment: LEED, Green globe, living building challenge. **08 Hours**

### Module – III

**Building energy and strategies:** Low energy buildings, renewable energy systems. Economic issues and analysis, Life cycle assessment.

**Comforts in Building:** Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations. **08 Hours**

## Module – IV

**Solar buildings:** Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings**.** **08 Hours**

## Module – V

**Green Composites for buildings**: Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment. **08 Hours**

## Course Outcomes:

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

- Know the applications of building materials and energy involved.
- Apply the different technologies and methods involved in green buildings.
- Study different Strategies involved in green building.
- Summarize importance of solar energy in green buildings.
- Assess the causes and effects of waste and to know the effects on green buildings.

## Text Books:

1. K.S.Jagadish, B. U. Venkataramareddy, K. S. Nanjundarao: "Alternative Building Materials and Technologies", (Chapters 1-4,6), 2nd Edition, New Age International, 2007, ISBN: 978-93-859-2387-6 ,
2. Peavy, Tchobanoglous: "Environmental Engineering", Volume-2, (Chapters 6,10-12), ISBN: 0-07-049134-8.

## Reference books:

1. Osman Attmann: "Green Architecture Advanced Technologies and Materials", (Chapters 2,4,6-9) McGraw Hill, 2010, ISBN: 9780071625012.
2. Jerry Yudelson: "Green building Through Integrated Design", (Chapters 5-7) McGraw Hill, 2009, ISBN: 9780071546010.
3. Walker, B, W. Steffen: "Global change and terrestrial ecosystems", International geosphere-biosphere programme book series, Cambridge University Press, 1996, ISBN-13: 9780521578103.

# Building Services

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT562 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Provide fundamental knowledge of water supply system, drainage system, electrical services, illumination and lighting design, concept of HVAC.

## Syllabus

### Module – I

**Water Supply:** Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom, taps, quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit. **08 Hours**

### Module – II

**Drainage:** Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers.

**Traps:** Shapes, sizes, types, materials and function, Inspection chambers - sizes and construction.

**Ventilation of House drainage:** Anti siphonage pipe, system of plumbing - single stack, one pipe system, one pipe partially ventilating system and two pipe system, grey water recycling and dual plumbing.

**Types of fixtures and materials:** sinks, shower tray, shower temple, bath tub, Jacuzzi, water closets, flushing cisterns, urinals, sinks, washbasins, bidet, etc. **08 Hours**

### Module – III

**Electrical Services: Electrical systems:** Basic of electricity- Single/Three phase supply, Protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice, Planning electrical wiring for building, Main and distribution boards, Principles of illumination. **08 Hours**

### Module – IV

**Illumination and Lighting Design:** Visual tasks, Factors affecting visual tasks. Modern theory of light and colour, synthesis of light, Additive and subtractive synthesis of colour, Luminous flux, Candle, Solid angle illumination, Utilization factor, Depreciation factor, MSCP, MHCP, Laws of illumination.

**Electrical Layout of Simple Buildings:** Electrical layout of a simple residential, school. **08 Hours**

## Module – V

**Heat Ventilation and Air Conditioning (HVAC):** Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity.

**General methods of thermal insulation:** Thermal insulation of roofs, exposed walls. **Ventilation:** Definition and necessity, system of ventilation. Principles of air conditioning Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system. **08 Hours**

### Course Outcomes:

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

- Analyze of water supply, water purifying techniques, different types of storages of water in multi-storeyed building.
- Adopt the principles of drainage, different types of traps, ventilation of house drainage and types of fixtures and materials.
- Apply the basic electrical system.
- Demonstrate the illumination and lighting design and electrical layout for different type of structures.
- Apply the concept of HVAC.

### Text Books:

1. E.R.Ambrose: “Heat pumps and Electric Heating”, John and Wiley and Sons Inc., New York, 1968.
2. R.G.Hopkinson, J.D.Kay: “The Lighting of Buildings”, Faber, and Faber, London, 1969.

### Reference Books:

1. Charangith Shah: “Water supply and sanitary engineering”, Galgotia publishers.
2. A. Kamala, D L Kanth Rao: “Environmental Engineering”, Tata McGraw-Hill publishing company limited.
3. Technical Teachers Training Institute (Madras): “Environmental Engineering”, Tata McGraw Hill publishing company limited.
4. National Building Code 2005.

### E-Resources:

1. https://en.wikipedia.org/wiki/Building_services_engineering
2. https://en.wikipedia.org/wiki/HVAC
3. https://en.wikipedia.org/wiki/Building_services_engineering
4. https://en.wikipedia.org/wiki/Architectural_lighting_design

# Hydrology and Irrigation Engineering

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT563 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Introduce student to hydrologic cycle and its components.
- Provide knowledge about the stream flow and important concepts associated with it.
- Provide basic knowledge about irrigation.
- Provide the knowledge about soil-water-crop relationship especially considering Indian conditions.
- Understand the methodology to assess irrigation water requirement.

## Syllabus

### Module – I

**Hydrology and Precipitation:** Introduction Atmospheric circulation, water vapor, formation of rainfall, Hydrologic cycle (Horton's representation). Water budget equation. Precipitation: Introduction, forms of precipitation, types of precipitation, measurement of precipitation, methods of computing average rainfall, interpolation of missing data, adjustment of missing data by double mass curve method. Hyetograph and mass curve of rainfall. (Theory and Problems). **08 Hours**

### Module – II

**Losses from Precipitation:** Evaporation: Definition, factors affecting, measurement (Class A pan). Estimation using empirical methods (Meyer's and Rohwer's equation), evaporation control. Evapo-transpiration: Definition, factors affecting, measurement, estimation (Blaney criddle method). Infiltration: Definition, factors affecting, measurement (double ring in filtrometer), infiltration indices, Horton's equation of infiltration. (Theory and Problems). **08 Hours**

### Module – III

**Stream Flow and Hydrographs:** Stream – classification of stream, stream gauging, measurement of discharge, stage-discharge relations. Introduction to Hydrograph – Definition, Factors affecting flood hydrograph, Components of a hydrograph, Base flow separation, Effective rainfall, Unit Hydrograph- Definition, Assumptions and Limitations of Unit hydrograph, Derivation of units of hydrograph, Unit hydrograph from complex storms, Unit hydrograph of different durations , S - Curve method.

**08 Hours**

## Module – IV

**Irrigation Engineering:** Introduction, need for irrigation, advantages and disadvantages of irrigation, environmental impacts of irrigation, Systems of irrigation: Gravity irrigation, lift irrigation, well irrigation, tube-well irrigation, infiltration galleries, sewage irrigation, supplemental irrigation.

Introduction, soil profile, physical properties of soil, soil classification. Indian soils, functions of irrigation soils, maintaining soil fertility, soil-water-plant relationship, soil-moisture. Irrigation relationship, frequency of irrigation. **08 Hours**

## Module-V

**Water Requirement of Crops and Design of Canals:** Introduction, definitions, crop seasons of India, water requirement of a crop, duty, delta, base period, Consumptive use, Irrigation efficiencies, Assessment of irrigation water.

Definition, Types of canals, Alignment of canals, Design of canals by Kenedy's and Lacey's methods. **08 Hours**

### Course Outcomes:

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

- Gain basic knowledge about hydrology and irrigation, and more precisely for Indian conditions.
- Analyze streamflow in accordance to the requirement.
- Gain basic knowledge about irrigation and irrigation system in Indian context.
- Formulate and analyze the relationship between soil-water-crop.
- Estimate irrigation water requirement, and design canals accordingly especially considering Indian conditions.

### Text Books:

1. Subramanya K: "Hydrology", Tata McGraw Hill Co., New Delhi, ISBN: 9781259029974.
2. Madan Mohan Das, Mim Mohan Das: "Hydrology", PHI Learning Private Ltd., New Delhi, 2009, ISBN: 9788120337077.
3. Jayarami Reddy: "A Text Book of Hydrology", Lakshmi Publications, New Delhi, ISBN: 9788170080992.

### Reference Books:

1. Ven Te Chow: "Handbook of applied hydrology", McGraw Hill Book company 1964, ISBN: 978-0070107748.
2. S. K. Garg: "Irrigation Engineering and Hydraulic structures", Khanna Publication, New Delhi, ISBN: 978-8174090478.

3. P.N.Modi: “Irrigation, Water Resources and Water Power Engineering”, Standard Book house, New Delhi, ISBN: 978-8189401290.
4. R.K.Sharma: “Hydrology and Water Resources Engineering”, New Delhi, ISBN: EBK0019826.

**E-Resources:**

1. http://nptel.ac.in/downloads/105105110/
2. http://www.vtulive.com/downloads/download/civil-v-hydrology-and-irrigation-engineering-notes-pdf/
3. http://www.uobabylon.edu.iq/uobColeges/ad_downloads/4_23319_838.pdf
4. https://www.slideshare.net

# Fluid Mechanics Lab

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL57 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Provide an opportunity to apply the knowledge gained in the field of fluid mechanics and hydraulics.
- Analyze static and dynamic fluid conditions using Bernoulli's equation of motion.
- Calibrate various types of notches and weirs used in measurement of flows.
- Estimate the major loss of head in pipe flow.
- Visualize and analyze the impact of jets on various types of vanes and evaluate performance characteristics of turbines and pump.

## Syllabus

1. Calibration of collecting tank (gravimetric method)
2. Calibration of pressure gauge (dead weight method)
3. Verification of Bernoulli's equation
4. Calibration of 90° V-notch
5. Calibration of Rectangular notch
6. Calibration of Venturiflume
7. Calibration of Venturimeter
8. Determination of Darcy's friction factor for a straight pipe
9. Determination of vane coefficients for a flat vane andsemicircular vane
10. Performance characteristics of a multi-stage centrifugal pump
11. Performance characteristics of a Pelton wheel
12. Performance characteristics of a Kaplan turbine.

## Course Outcomes:

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

- Apply the knowledge gained in the field of fluid mechanics and hydraulics.
- Demonstrate and analyze static and dynamic fluid conditions.
- Gain knowledge about measurement of flows and will be able to calibrate them.
- Estimate the major loss of head in pipe flow.
- Analyze the impact of jets on various types of vanes and evaluate performance characteristics of turbines and pump.

## Reference Books:

1. Sarbjit Singh: "Experiments in Fluid Mechanics", PHI Pvt. Ltd., New Delhi, ISBN: 978-8120337626.
2. Dr. N. Balasubramanya: "Hydraulics and Hydraulic Mechines Laboratory Manual".
3. Lab manual provided by Dept. of Civil Engg., NCET.

# Analysis and Design Lab – I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL58 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Use different types of FEM software in Civil Engineering.
- Impart the basic knowledge of Analysis of different components of Structures.
- Impart the knowledge of spread sheet in solving Civil Engineering problems.

## Syllabus

**Structural Analysis Software:**

Use of commercially available FEM software for the analysis of :

i. Propped cantilever beams Fixed beams , Continuous beams
ii. Slabs
iii. Cables and Arches
iv. 2D Portal frames-single storied and multi-storeyed

**Use of Excel In Civil Engineering Problems:**

Use of spread sheet for the following civil engineering problems :

i) SFD and BMD for Cantilever and simply supported beam subjected to Point load, uniformly distributed and uniformly varying load acting throughout the span
ii) Computation of earthwork
iii) Design of horizontal curve by offset method
iv) Design of super elevation
v) Design of singly reinforced and doubly reinforced rectangular beams
vi) Design of columns and footings
vii) Design of one way slabs

## Course Outcomes:

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

- Impart knowledge of FEM software for the analysis of structural elements.
- Draw SFD and BMD for various kind of beam using Excel.
- Prepare design spared sheet.
- Design RCC components using Excel.
- Plot graph for various problems using excel

## Text Books:

1. Dr. M.N.Shesha Prakash, Dr. G.S.Suresh: "Computer Aided Design Laboratory", Lakshmi Publications.
2. M.A.Jayaram, D.S.Rajendra Prasad: "CAD Laboratory", Sapna Publications Learning.
3. Ramesh Bangia: "Excel", Khanna Book Publishing Co. (P) Ltd., Microsoft, 2002, ISBN-10: 8187522577, ISBN-13: 978-8187522577.
4. Krishnamoorthy, C.S., Rajeev, S.: "Computer Aided Design and Analytical Tools", Narosa, 1993, 2nd Edition, ISBN: 978-81-7319-495-5.

## Reference Books:

1. Vazirani V.N., Ratwani N.M.: "Strength of Materials", Vol. II, Khanna Publishers, 1996.
2. Ashok, Kumar Jain: "Reinforced Concrete Limit State Design", Nem Chand Brothers, 1990.
3. Jindal. R.L: "Indeterminate Structures", Chan Tea, New Delhi, 2000.
4. Punmia B.C.: "Theory of Structures", Standard Book House, New Delhi, 2000.
5. Lab manual provided by Dept. of Civil Engg., NCET.

## E-Resources:

1. https://www.researchgate.net/publication/273453659_CAD_in_Civil_Engineering_A_La
2. www.sit.ac.in/department/mca/publication/jayaram.pdf

# General Aptitude

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVH59 | 2:0:0:0 | 2 | CIE:50 SEE:50 | 3 Hours | HSS |

## Course Objectives:

This course will enable students to :

- Understand different types of Numerical / Arithmetical problems.
- Understand the different Data interpretation problems.

## Syllabus

### Module – I

**Numerical Ability-I:** Numbers, HCF and LCM of numbers, Decimal Fractions, Average, Problems on Numbers, Problems on Ages. **06 Hours**

### Module – II

**Numerical Ability-II:** Percentage, Profit and Loss, Ratio and Proportion, Partnership, Chain Rule, Time and Work. **05 Hours**

### Module – III

**Numerical Ability-III:** Pipes and Cistern, Time and Distance, Problems on Trains, Alligation or Mixture, Simple Interest, Compound Interest. **05 Hours**

### Module – IV

**Numerical Ability-IV:** Races and Games of Skill, Calender, Clocks, Permutations and Combinations, Probability, Odd man out and Series. **05 Hours**

### Module-V

**Data Interpretation:** Tabulation, Bar Graphs, Pie Charts, Line Graphs. **05 Hours**

## Course Outcomes:

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

- Solve and analyze different types of Numerical / Arithmetical problems.
- Solve and analyze different Data interpretation problems.

## Text Books:

1. R S Aggarwal, “Quantitative Aptitude for competitive examinations”, (Chapters 1-3,6-8,10-18,20-22,26-28,30,31,35-39), S. Chand Publishing, New Delhi, 2014, ISBN-13: 978-81-219-2498-6.

# Sixth Semester B.E. – Syllabus
# Design of Steel Structures (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI61 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

**Course Objectives:**

This course will enable students to :

- Learn the Limit State Design concept of structural steel members.
- Understand the plastic behaviour of steel structural beams.
- Analyze the behavior of different connections used in steel structures.
- Understand the procedure of designing a steel structural component such as tension members, compression members and flexural members.

**Syllabus**

## Module – I

**Introduction:** Advantages and Disadvantages of Steel structures, loads, load combination, Failure criteria for steel, Codes, Specifications and section classification.

**Plastic Behavior of Structural Steel:** Introduction, Plastic theory, Plastic hinge concept, conditions of plastic analysis, Theorem of Plastic collapse and Plastic analysis of continuous beams. **08 Hours**

## Module – II

**Bolted Connections:** Advantages and Limitations of bolted joints, Design strength of ordinary Black Bolts and High Strength Friction Grip bolts (HSFG), Design of Simple Connections, Moment resistant connections.

**Welded Connections:** Advantages of Welding, Types and Properties of Welds, Weld specifications, Design of welds, Simple joints and Moment resistant connections. Design and drawing of Beam to Beam connection. **08 Hours**

## Module – III

**Design of Tension Members:** Introduction, Types of tension members, Design of strands, slenderness ratio, behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets. **08 Hours**

## Module – IV

**Design of Compression Members:** Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, Built up compression members. **08 Hours**

## Module-V

**Flexural Members:** Introduction, Beam types, lateral stability of beams, factors affecting lateral stability, Design of laterally supported and laterally unsupported beams.

**Bases:** Design of simple slab base and gusseted base. **08 Hours**

**Laboratory Activities: Students have to draw the following structural elements using AUTO-CAD software.**

| Sl. No. | Name of the Activity |
|---|---|
| 1 | Bolted and welded connections. |
| 2 | Beam to Beam connections. |
| 3 | Beam to column connections. |
| 4 | Flexural members. |
| 5 | Simple slab base and gusseted base connections |

### Course Outcomes:

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

- Apply the concept of Limit State Design of steel structures.
- Analyze and design steel structural beams subjected to plastic behavior.
- Capable of design various steel components using bolted and welded connections and also to develop a Cad drawing for the fabrication of different components of structures.
- Apply Indian Standard codal provisions for the design of tension and compression members.
- Design flexural members and bases.

### Text Books:

1. N Subramanian: “Design of Steel structures”, (Chapters 1,5-9), Oxford University Press, 11th Edition, 2013, ISBN: 9780195676815.
2. Duggal: “Limit State Design of Steel Structures”, (Chapters 1-8), Tata Mcgraw Hill, Edition, 2010, ISBN: 9781259083785.

### Reference Books:

1. S S Bhavikatti: “Design of Steel Structures”, (Chapters 1-6), I K International Pvt. Ltd., 2009, ISBN: 9789380026619.
2. Dr. B C Punmia, Dr. A K Jain: “Comprehensive Design of Steel Structures”, (Chapters 2-6), Firewall Media, 1998, ISBN: 9788170080930.

### E-Resources:

1. http://nptel.ac.in/courses/105106112/
2. http://nptel.ac.in/courses/IITMADRAS/Design_Steel_Structures_I/index.php
3. http://iitmweb.iitm.ac.in/phase2/courses/105103094/12

# Geotechnical Engineering - I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT62 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to : :

- Understand what Geotechnical Engineering is and how it is important to civil engineering. Usage of three phase system.
- Estimate soil properties in the laboratory.
- Understand role of water in soil behavior and how soil stresses, permeability and moisture content-dry density relationships are estimated.
- Estimate the magnitude and time rate of settlement due to consolidation.
- Determine shear parameters and stress changes in soil due to foundation loads.

## Syllabus

### Module - I

**Introduction:** Introduction, origin and formation of soil, Phase Diagram, Basic definitions and their interrelationships.

**Index Properties of Soils and their Determinations:** Moisture content, Specific Gravity, Particle size distribution by Sieve analysis, In-situ density by core cutter and sand replacement methods. **08 Hours**

### Module – II

**Consistency of Soils:** Atterberg limits and indices. Liquid Limit by Casagrande's method, Plastic limit and shrinkage limit determination.

**Classification of Soils:** Purpose of soil classification, basis for soil classification, Particle size classification and IS classification, Unified soil classification, Plasticity chart and its importance, Field identification of soils. **08 Hours**

### Module – III

**Soil Water and Permeability of Soil :** Darcy's law- assumptions and validity, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, quick sand phenomenon, Capillary Phenomena.

**Compressibility of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, types of field compaction. **08 Hours**

## Module – IV

**Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumptions, limitations and applications (no derivation), Normally, under and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, Determination of consolidation characteristics of soils-compression index, and coefficient of consolidation, Determination of coefficient of consolidation by square root of time fitting method, logarithm of time fitting method. **08 Hours**

## Module – V

**Shear Strength of Soils:** Concept of shear strength, Mohr-coulomb theory, conventional and modified failure envelops, Total and effective shear strength parameters, Concept of pore pressure, factors affecting shear strength of soils, Measurement of shear parameters- Direct shear test, Unconfined compression test, Triaxial compression test and Vane shear test, Shear strength tests under different drainage conditions, importance of pore pressure and shear strength in geotechnical applications. **08 Hours**

### Course Outcomes:

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

- Solve three phase system problems.
- Carry out index properties of soil and classification.
- Solve any practical problems related to permeability and compaction.
- Solve practical problems related to consolidation settlement and time rate of settlement.
- Estimate the shear strength parameters in cohesive and cohesion less soils.

### Text Books:

1. Punmia B.C.: "Soil Mechanics and Foundation Engg.", 16th Edition, Laxmi Publications Co., New Delhi, 2005, ISBN: 978-8170087915.
2. Gopal Ranjan, Rao A.S.R.: " Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi, 2006, ISBN: 978-8122412239.
3. Venkatramiah C., "Geotechnical Engineering", New Age International (P) Ltd., Publishers, New Delhi, 2010, ISBN: 978-8122433517.

4. Head K.H.: "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London, 1986, ISBN: 978-0727313058.5.
5. Bowles J.E.: "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York, 1988, ISBN: 978-0070067516.

**Reference Books:**

1. Lambe, Whitman: "Soil Mechanics", Wiley India Pvt. Ltd., New York, 2012, ISBN: 978-8126539918.
2. Terzaghi. K., Peck. R.B.: "Soil mechanics in Engineering practice", 3rd Edition, John Wiley and Sons, New York, 1996, ISBN: 978-0471086581.
3. Ramamurthy T.N., Sitharam T.G.: "Geotechnical Engineering", S.Chand and Company, New Delhi, 2010, ISBN: 978-8121924573.
4. Alam Singh, Chowdhary G.R.: "Soil Engineering in Theory and Practice"' CBS Publishers and Distributors Ltd., 2nd Edition, New Delhi, 2009, ISBN: 978-8123900391.
5. Murthy V.N.S.: "Soil Mechanics and Foundation Engineering", 4th Edition, UBS Publishers and Distributors Ltd., New Delhi, 2009, ISBN: 978-8123913629.
6. Dr. K.R.Arora: "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi,ISBN: 978-8180141126.
7. Braja M. Das: "Principles of Geotechnical Engineering", 8th Edition, Cengage Learning India (P) Ltd., India, 2015, ISBN: 978-8131526132.

**E-Resources:**

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil_mech/index.htm
2. http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html
3. http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf
4. http://en.m.wikipedia.org/wiki/geotechnical _engineering
5. accessengineeringlibrary,com/browse/geotechnical-engineering-soil-and-foundation-principles-and-practice-fifth-Edition

# Environmental Engineering (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI63 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Understand the basic concepts and principles of Collection and conveyance of water.
- Identify the ill effects of environmental pollution.
- Understand the basic principles, concepts and Design of unit operations and
- Processes involved in water treatment and waste water.
- Develop a student's skill in evaluating the performance of water and waste water treatment plants.
- Understand the concepts estimating different parameters of the water and waste water quality

## Syllabus

### Module - I

**Introduction:** Requirement of water for various beneficial uses.

**Demand of Water:** Types of water demands-domestic demand, institutional and commercial, public uses, fire demand. Per capita consumption-factors affecting per capita demand, population forecasting, different methods with merits and demerits-variations in demand of water. Fire demand by kuichling's formula, Freeman formula and national board of fire underwriters formula, peak factors, design period and factors governing the design periods. **08 Hours**

### Module – II

**Quality of Water:** Objectives of water quality management. Wholesomeness and palatability, Water quality parameters-physical, chemical, microbiological. Drinking water standards BIS and WHO guidelines.

**Water Treatment:** Objectives- Treatment flow-chart. Sedimentation: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test. **08 Hours**

## Module – III

**Aeration:** Principles, types of Aerators.

**Filtration:** Mechanism-theory of Filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design-excluding under drainage system-back washing of filters. Operational problems in filters.

**Disinfection:** Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV rays. Treatment of swimming pool water**.**

**Softening:** definition methods of removal of hardness by lime soda process and zeolite process RO and membrane technique. **08 Hours**

## Module – IV

**Introduction to waste water:** Necessity for sanitation, methods of domestic waste water disposal.

**Waste Water Characterization:** Sampling, significance, techniques and frequency. Physical, chemical and biological characteristics, aerobic and anaerobic activities, CNS cycles. BOD and COD. Their significance and problems. **08 Hours**

## Module – V

**Treatment of waste water:** Flow diagram of municipal waste water treatment plant.

**Primary and Secondary waste water treatment:** Screening, Primary sedimentation tank. Trickling filter, Activated sludge process and Anaerobic sludge digestion tanks including theory and operation.. **08 Hours**

## Environmental Engineering Laboratory

| Sl. No. | Name of the experiment |
|---|---|
| 1 | Determination of pH and Electrical conductivity. |
| 2 | Determination of Acidity, Alkalinity. |
| 3 | Determination of Calcium, magnesium and Total hardness. |
| 4 | Determination of Solids in sewage: Total solids, suspended solids, Dissolved solids and settle able solids. |
| 5 | Determination of Chlorides. |
| 6 | Determination of Dissolved oxygen and BOD. |
| 7 | Determination of COD. |
| 8 | Determination of Optimum Dosage of Alum using Jar Test Apparatus, Turbidity determination by Nephelometer. |
| 9 | Determination of percentage of available chlorine in bleaching powder. |

## Course Outcomes:

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

- Recognize the importance of water to protect the water resources which is facing a continuous degradation in water quality.
- Recognize that water supply and sanitation is an important professional and ethical responsibility of civil engineer.
- Demonstrate an ability to recognize the type of unit operations and processes involved in water and waste water treatment plants.
- Demonstrate an ability to design individual unit operation in treatment of water and waste water.
- Demonstrate ability in monitoring and analysis of water and waste water quality parameters.

## Text Books:

1 Garg S.K.: "Environmental Engineering", Vols. I and II, ( Chapters 1,2,8,9 and Chapters 2-8), 12th Edition, Khanna Publishers, New Delhi, 2001, ISBN: 81-7409-120-3.

2. B.C.Punmia: "Water Supply Engineering", (Chapters 1,5,6,8,9), Arihant Publications, ISBN: 81-7008-092-4.

3. Metcalf and Eddy Inc.: "Waste water Treatment, Disposal and Reuse", (Chapters 1-9), Tata McGraw Hill Publications, ISBN: 9780070495395.

## Reference Book:

1. Rangwala: "Water supply and sanitary engineering", (Chapters 1,2,5-10,17-20,27-30), ISBN: 81-85594-59-7.

## E-Resources:

1. https://ecommons.cornell.edu
2. https://doi.org/10.1016/j.enbsoft

# Construction Industry Practice – II

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT641 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to : :

- Learn about Geotechnical investigation,
- Principles of Analysis of RC and steel Buildings,
- Implement these principles in designing and detailing of RC and steel Buildings.

## Syllabus

### Module - I

**Geotechnical Investigation:** (Bore Hole Location, Types of test, Importance and Interpretation of report). **08 Hours**

### Module – II

Analysis and design of RC building. **08 Hours**

### Module – III

Analysis and design of steel building. **08 Hours**

### Module – IV

Detailing of RCC building. **08 Hours**

### Module – V

Detailing of steel building. **08 Hours**

## Course Outcomes:

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

- Execute Soil Investigation.
- Execute analysis and design of RC Buildings.
- Execute analysis and design of Steel Buildings.
- Gain the Knowledge of Detailing of RC and Steel Buildings.

# Advanced Transportation Engineering

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT642 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Understand the importance of Railway Engg and rail requirements in India and Sleepers and Ballast.
- Understand the importance of Traction and Tractive resistance and Geometric design of rails.
- Understand the introduction to airport and runway design.
- Understand the introduction Tunnel Engineering.
- Understand the importance of Harbors and Docks.

## Syllabus

### Module - I

**Railway Engineering:** Advantages of railways as transportation mode, Typical cross sections, suitability of different gauges, Coning of wheels, components of the permanent way - Rails, Sleepers, Ballast and Fixtures - functions, types, requirements. Functions, requirements, Track fitting and fasteners-Fish plates-bearing plates, Calculation of quantity of materials required for laying a track-Examples. **08 Hours**

### Module – II

**Traction And Tractive Resistance:** Traction and Tractive resistance, Gradients, super elevation, cant deficiency, Negative super elevation, Points and crossings, Salient features of Metro transport.

**Geometric Design of Railways:** Necessity, Safe speed on curves, Cant-cant deficiency-negative cant-safe speed based on various criteria, (both for normal and high speed tracks) Transition curve, Gradient and types, grade compensation, Examples on above. **08 Hours**

### Module – III

**Airport Engineering:** Features and Role of Airways in transportation, Aircraft characteristics, Air transportation planning, site selection, Airport components and diagram, basic length and corrected length of runway length, Taxiway - Turning radius, exit taxiway, design factors and elements. **08 Hours**

### Module – IV

**Tunnel Engineering And Harbours:** Advantages and disadvantages, Different shapes of tunnels, Surveying-Transferring centre line, and gradient from surface to inside the tunnel working face, Tunneling in rocks-Drift method, Heading and benching method, Tunneling methods in soils-Needle beam, Liner plate, Tunnel lining, Tunnel ventilation, Pilot tunneling. **08 Hours**

## Module – V

**Harbours and Docks:** Types, components, Natural phenomenon affecting the design of harbours. Wind, wave and tides. Currents, Breakwaters - types, wharf and quays, Jetties and piers. Spillways.

**Docks**: Dry dock and wet docks, Slipways, Navigational aids, warehouse and transit-shed. **08 Hours**

### Course Outcomes:

On completion of the course, This course will enable students to :

- Know the importance of Railway Engineering in transportation sector.
- Recognize the importance of Traction and Tractive resistance and Geometric Design in Railways.
- Recognize the importance of Airport Engg and Basic Runway Design.
- Define the Tunnel, Different types of tunnels and methods of tunneling.
- Learn the importance of Harbour and dock construction.

### Text Books:,

1. S.C. Saxena and S.P Arora: "Railway Engineering", (Chapters 1-11, 15), 7th Edition, Dhanpat Rai Publications, New Delhi, ISBN: 9788189928834.
2. S.K Khanna, M.G Arora, S.S Jain - Airport Planning and Design, (Chapters 1,3,5-8), 6th Edition, Nem Chand Bros - Roorkee, ISBN: 81-85240-68-10.
3. R. Srinivasan: "Harbour, Dock and Tunnel Engineering", (Chapters 1-3), Charaotar Publishing House, 28th Edition, 2016, ISBN: 9789385039195.

### Reference Books:

1. J S Mundery: "Railway Track Engineering", (Chapters 1-5), Tata McGraw-Hill Education, 4th Edition, 2009.
2. Hasmukh P. Oza, Gautam H. Oza "Dock and Harbour Engineering", (Chapters 8-12,17,21), 7th Edition, Charotar Publishing house Pvt. Ltd., Gujarat, India, ISBN: 9789380358789.

### E-Resources:

1. http:nptel.ac.in/courses/105107123/
2. https://www.railelectrica.com/traction-mechanics/train-grade-curve-and-acceleration-resistance-2/
3. http://www.faa.gov/airports/engineering/
4. https://sites.google.com/a/venusict.org/dha/material

# Earthquake Resistant Design of Structures

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT643 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Learn the principles of engineering seismology.
- Learn the design of reinforced concrete building for earthquake resistance.
- Learn the Seismic response of the structure.

## Syllabus

### Module - I

**Introduction:** Earthquake ground Motion, Engineering Seismology, Theory of plate tectonics, seismic waves, Magnitude and intensity of earthquakes, local site effects, seismic zoning map of India.

**Seismic Design Parameters:** Seismic Design Parameters Types of Earthquakes, earthquake ground motion characteristics response spectra and design spectrum.

**08 Hours**

### Module – II

**Structural Modelling:** Code based seismic design methods. Response control concepts, seismic evaluation and retrofitting methods.

**Structural Irregularities:** Effect of Structural Irregularities on seismic performance of RC buildings. Vertical irregularity and plan configuration problems, Seism resistant building architecture – lateral load resistant systems, building characteristics.

**08 Hours**

### Module – III

**Lateral force analysis:** Seismic design philosophy, Determination of design lateral forces -Equivalent lateral force procedure, dynamic analysis procedure.

**Seismic analysis:** Step by step procedure for seismic analysis of RC buildings (maximum of 4storeys , without infill's) - Equivalent static lateral force method, response spectrum methods. **08 Hours**

### Module – IV

**Earthquake Resistant Analysis And Design of Rc Buildings** – Preliminary data, loading data, load combinations, analysis and design of sub frames. (maximum of 4 storeys, without infill's). **08 Hours**

## Module – V

**Earthquake Resistant Design of Masonry Buildings:** Elastic properties of structural masonry, lateral load analysis, Design of two storied masonry buildings.

**08 Hours**

### Course Outcomes:

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

- Achieve knowledge of earthquake and seismic design parameter.
- Summarize the structural irregularities and seismic deign methods.
- Analyze seismic forces acting on building by various method.
- Analyze and design sub frames and RC buildings.
- Design masonry building for earthquake resistance

### Text Books:

1. Pankaj Agrawal, Manish Shrikhande: "Earthquake Resistant Design of Structure", PHI Learning Pvt. Ltd., 2006, 3rd Edition, ISBN: 9788120328921.
2. S.K Duggal, "Earthquake-resistant Design of Structures", Oxford University Press, 2nd Edition, ISBN: 9780198083528.

### Reference Books:

1. Edmund Booth ,"Earthquake design practice for building", 3rd Edition, ICE Publishing, 2014, ISBN: 978-0727757944.
2. Miha Tomaževič: "Earthquake-resistant Design of Masonry Buildings", 2nd Edition, Imperial College Press, ISBN: 9781860940668.

### E-Resources:

1. http://elearning.vtu.ac.in/06CV834.html
2. http://elearning.vtu.ac.in/18/enotes/06CV834/EQ-GPCt.pdf
3. http://elearning.vtu.ac.in/18/enotes/06CV834/Unit1&2-SKP.pdf
4. http://elearning.vtu.ac.in/18/enotes/06CV834/Unit7-PN.pdf

# Pollution Control and Management

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT651 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Understand the factors that must be satisfied for potable water, land and air for the removal and treatment of pollutants.
- Provide a strong link between the Pollution Damage, Public Authority Control Systems and Technical Control Systems.
- Know the relationship between social, legislative and biological constraints in a modern developed society

## Syllabus

### Module - I

**Water Pollution and Control:** Natural process-pollution due to industrial, agricultural and municipal wastes-limitations of disposal by dilution-BOD consideration in streams – Oxygen Sag Curve-Water pollution control legislation.

**08 Hours**

### Module – II

**Air Pollution and Control:** Pollution and their sources-effects of pollution on human health, vegetation and climate prevention and control of particulate-industry and air-pollution surveys and sampling-Air quality monitoring- air pollution control legislation. **08 Hours**

### Module – III

**Noise Pollution and Control:** Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution; fundamentals of sound generation, propagation etc; sound measurement; sound level meters – types, components, Measures for prevention and control of noise; environmental and industrial noise; noise control legislation **08 Hours**

### Module – IV

**Solid Waste Management:** Source characteristics – quantities – collection methods and disposal techniques – sanitary landfill – incineration – and pyrolysis, composting, aerobic and anaerobic- economics of composting; recycling and reuse.

**08 Hours**

## Module – V

**Environmental Sanitation:** Relation of food to disease-principles of food sanitation-sanitation of kitchens, restaurants and other catering establishments-quality changes in milk-milk as carrier of infection-pasteurisation of milk-HTST and LTLT processes – cattle shed sanitation. Orientation of buildings with respect to the direction of prevailing winds and solar movement. Air movement inside the buildings for a healthy residential environment **08 Hours**

### Course Outcomes:

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

- Describe the principles of the biological and chemical treatment processes that are required to ensure adequate quality and quantities of potable water.
- Implement the principal techniques currently in use for wastewater treatment and to review operational procedures for the plant involved.
- Use advanced methods for monitoring and modeling spatial and temporal patterns of pollution.
- Analyze the different methods for solid waste management in the cities.
- Apply the concept of environmental sanitation process.

### Text Books :

1. Peavy, H.S., Rowe, D.R, George Tcnobanoglous, “Environmental Engineering”, Mc-Graw Hill company, New Delhi, 2001, ISBN: 978-9351340263.
2. Rao C.S.: “Environmental Pollution Control Engineering”, Wiley Eastern Ltd., New Delhi, 1996, ISBN: 978-8122418354.

### Reference Books :

1. Vesilind: “Introducing to Environmental Engineering”, PWS Publishing Company, 1997, ISBN: 1118785991.
2. Gerard Kiley: “Environmental Engineering”, 1st Edition, Irwin McGraw-Hill, 1997, ISBN: 9780077091279.

### E-Resources:

1. https://qualifications.pearson.com/Unit-17-Pollution-Control-and-Management.pdf
2. www.ilocis.org/documents/chpt55e.html
3. www.indiaenvironmentportal.org.in/indian-journal-of-air-pollution-control/
4. www.scimagojr.com/journalsearch.php?q=23413&tip=sid

# Water Resources Engineering

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT652 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Prepare the students for a successful career as hydrologist and water resources engineers.
- Develop the ability among students to synthesis data and technical concepts for application in hydrology and water resources engineering.
- Provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, analyze, solve engineering problems and to prepare them for their career.
- Provide students with advanced tools of data collection and the analysis of the same with respect to water resources.
- Promote student awareness for the lifelong learning and to introduce them professional ethics and codes of professional practice in water resources management.

## Syllabus

### Module - I

**Basics of Hydrometeorology:** Hydrologic cycle Global water budget Practical applications – Hydrometeorology Air front cyclones Formation of precipitation Types and forms of precipitation Climate and Weather Meteorological Observations.

**Precipitation:** Measurement of rainfall Rain gauges Radar Measurement of rainfall Rainfall Hyetograph Intensity Duration and Frequency analysis Consistency Missing data Rain gauge network Average depth of rainfall analysis (Theory and Problems).

**10 Hours**

### Module – II

**Surface Runoff:** Concept of catchment ,Linear, Areal and Relief Aspects, Detailed study of Runoff process, Factors affecting Runoff, Runoff estimation, Strange and SCS methods, yield estimation. **06 Hours**

### Module – III

**Ground Water:** Groundwater in Hydrologic Cycle Origin of groundwater, Rock properties affecting groundwater, Types of aquifer, Darcy‟s law, coefficient of permeability, groundwater flow rates, permeability formulae, laboratory and field measurement of permeability, Ground water movement. **08 Hours**

## Module – IV

**Water Harvesting And Conservation:** Water Harvesting Techniques Micro Catchments Design of Small Water Harvesting Structures – Farm Ponds Percolation Tanks Yield from a Catchment, Site selection for artificial recharge Rain water and Runoff Harvesting in Rural and Urban Areas Reservoir Sedimentation. **08 Hours**

## Module – V

**Watershed Management:** Project Proposal Formulation Watershed Development Plan Entry Point Activities Estimation Watershed Economics Agroforestry Grassland Management Wasteland Management Watershed Approach in Government Programmes Developing Collaborative know how People‟s Participation Evaluation of Watershed Management. **08 Hours**

### Course Outcomes:

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

- Explain hydrologic cycle and hydro meteorological measurements with a know how about various methods of field measurements and estimation of precipitation.
- Recognize the process of abstraction and runoff which they apply to carry out the assessment of water balance and runoff potential.
- Gain knowledge about basic aquifer parameters and groundwater resources for different hydro-geological boundary conditions.
- Recognize the need of water harvesting and conservation.
- Develop the water shed management concepts in accordance with importance to society.

### Text Books:

1. Subramanya K: “Hydrology”, Tata McGraw Hill Co., New Delhi, ISBN: 9781259029974.
2. Jeya Rami Reddy P: “Hydrology”, Laxmi Publications, New Delhi, ISBN: 9788170080992.
3. Vir Singh: “Watershed Planning and Management”, Raj Yash Publishing House, Bikaner, ISBN: 9788186882405.

### Reference Books:

1. Ven Te chow: “Handbook of applied hydrology”, McGraw Hill Book company. ISBN: 978-0070107748.
2. S. K. Garg: “Irrigation Engineering and Hydraulic structures”, Khanna Publication, New Delhi, ISBN: 978-8174090478.
3. P.N.Modi: “Irrigation, water Resources and water power Engineering”, Standard book house, New Delhi, ISBN: 978-8189401290.

# Pavement Materials and Construction

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT653 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Learn the basic road construction materials such as soils, aggregates, bitumen and Portland cement types, source, functions, requirements, properties.
- Know the various tests and specifications of different materials for use in various components of road.
- Know appropriate equipments required for construction depending upon the requirement.
- Prepare quality assurance and quality control plans in an attempt to construct better performing pavements

## Syllabus

### Module - I

**Soil:** Types, source, functions, properties. Preparation of subgrade, quality control tests. Construction of embankments for roads, compaction studies in laboratory and field, properties of compacted soils.

**Soil Stabilization:** Principle, methods and tests, proportioning of materials. Stabilizers and waste materials in road construction, their properties and scope in road construction. **08 Hours**

### Module – II

**Aggregates:** Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation, maximum aggregate size, Importance of aggregate gradation problems on Rotchfutch. **08 Hours**

### Module – III

**Bitumen and Tar:** Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.

**Bituminous Emulsions and Cutbacks:** Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion. **08 Hours**

### Module – IV

**Equipment in Highway Construction:** Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavements. **08 Hours**

## Module – V

**Construction of Flexible and Cement Concrete Pavements:** Specifications of materials, construction methods and field control checks for various types of flexible and rigid pavements layers. (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints. **08 Hours**

### Course Outcomes:

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

- Characterize the response characteristics of soil, aggregate, asphalt, and asphalt mixes
- Analyze flexible pavements.
- Analyze rigid pavements.
- Identify the various equipments required for construction of highways.
- Construct flexible pavement and rigid pavement.
- Prepare quality assurance and quality control plans during construction.

### Text Books:

1. Khanna, S.K., Justo, C.E.G.: "Highway Engineering", (Chapters 6-9), Nem Chand and Brothers, Roorkee, ISBN: 9788185240800.
2. S.C. Sharma: "Construction Equipment and its Management", (Chapters 1-4,6,7), Khanna Publishers, Delhi ,2013, ISBN: 9788174092281, 8174092285.
3. Freddy L. Roberts, Kandhal, P.S: "Hot Mix Asphalt Materials, Mixture Design and Construction", (Chapters 1,2), University of Texas Austin, Texas, NAPA Education Foundation Lanham, Maryland., ISBN-10: 0914313010, ISBN-13: 9780914313014.

### Reference Books:

1. Freddy L Roberts, Prithvi S Kandhal: "Hot Mix Asphalt Materials, mixture design and construction", 2nd Edition, National Asphalt Pavement Association Research and Education Foundation, Maryland, USA, ISBN-10: 0914313010, ISBN-13: 978-0914313014.
2. RRL, DSIR: "Bituminous Materials in Road Construction", HMSO Publication, ISBN: 9781138893764.
3. RRL, DSIR: "Soil Mechanics for Road Engineers", HMSO Publication, ISBN: 0115502785, 9780115502781.
4. Relevant IRC codes and MoRT and H specifications.

### E-Resources:

1. http://www.fhwa.dot.gov/pavement/pavemat.cfm
2. http://library.iitbbs.ac.in/book-info.php?id=53c3bce66e43be4f209556518c2fcb54
3. http://www.pppcatalog.com/store/pavement-maintenance-and-construction/
4. http://cce.oregonstate.edu/ptm
5. http://www.fhwa.dot.gov/pavement/asphalt/

# LabVIEW - Level I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE661 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Understand the fundamental of graphical coding system.
- Learn to develop basic level of LabVIEW coding.
- Study the different component of LabVIEW operating tools.
- Study and develop state machine for a specific problem.
- Develop integrated coding solution for analysis and presentation with MyRio hardware using accelerometer.

## Syllabus

### Module - I

**LabVIEW programming concepts, environment and Software constructs:** Data flow, Polymorphism, Front panel window, block diagram, and connector pane, Menus and palettes, Configuration options. Controls, indicators, IO controls, and refnums Terminals, constants, nodes, update modes, and legends of charts and graphs. Mechanical action of Boolean objects Property Nodes. Numeric, string, Boolean, and path data types. Array and cluster data types. Shift registers, Case, Sequence and Event structures. **10 Hours**

### Module - II

**Programming, Data communication and synchronization VIs and functions:** Conversion, comparison, and manipulation, Timing and Timing functions related to Timed structures. Data storage and file I/O formats, Waveform and waveform file I/O, Dynamic and User events Local, global, and shared variables Data Socket TCP and UDP Notifiers Queues Semaphores Property Nodes, and Invoke Nodes. **08 Hours**

### Module - III

**Error handling VIs and functions:** Error clusters Dialog and User Interface VIs Custom error codes.

**Design patterns:** Simple state machine, User interface event handler, Queued message handler, producer/consumer (data) and producer/consumer (events), Functional global variables. **06 Hours**

## Module - IV

**Sub VI design:** SubVI creation methods, Connector panes and connection types, Polymorphic subVIs, Options related

**Debugging tools and techniques:** Debugging tools, Error list window, Execution highlighting, Breakpoints and single stepping, Generic and custom probes, Debugging practices and techniques for different situations. **08 Hours**

## Module - V

**VI design and documentation (style) practices:** Refer to the LabVIEW Style Checklist topic of the LabVIEW Help for information on the following items

i. User interface design and block diagram layout

ii. Modular and hierarchical design

iii. SubVI icons and connector pane layout (standard)

iv. Properties

v. Documenting Vis

**Memory, performance, and determination**

a. Tools for identifying memory and performance issues

   Profile memory and performance, Show buffer allocations and VI metrics

b. Programming practices

Enforcing dataflow, User interface updates and response to user interface controls, Data type selection, coercion, and buffer allocation, Array, string, and loop operations **08 Hours**

### Course Outcomes:

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

- Formulate basic aspects of the graphical programming using LabVIEW 2016.
- Develop LabVIEW coding for a specific problem of datalogging, measurement and presentation.
- Handle the error function and errors in the LabVIEW coding.
- Develop coding for data handling and Analysis on the acquired data.
- Design a state machine LabVIEW coding for an applied problem.

## Text Books:

1. "LabVIEW - Getting Started with LabVIEW", M/s National Instruments, 2013 373427J-01.
2. Jovitha Jerome: "Virtual instrumentation using labview", PHI Learning Pvt. Ltd., 2010.
3. Hans-Petter Halvorsen: "Introduction to LabVIEW," University College of Southeast, Norway.
4. S. Sumathi, P. Surekha, "LabVIEW based Advanced Instrumentation Systems", Springer.
5. Lab manual provided by Dept. of Civil Engg., NCET.

## Reference Books:

1. Jeffrey Travis, Jim Kring: "Introduction to Graphical Programming with LabVIEW", Pearson, 2006.
2. Malan Shiralkar: "LabVIEW Graphical Programming Course Collection", National Instruments.

## E-Resources:

1. http://cnx.org/content/col10241/1.4.

# Yoga and Meditation

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE662 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Introduce the main principles of Yoga.
- Generate knowledge and skills of students to use the tools and techniques for using Yoga in day to day life for better health and well being.
- Improve communication and increase concentration through Yoga and Meditation.
- Equip the individual to handle stressful situations and manage day to day activities.

## Syllabus

### Module – I

**Definition and meaning of yoga:** Meaning of Asanas, Types of Asanas: standing, sitting and supine asanas. Standing Asanas (Trikon asan, padhastasan, ardhachakrasan, veerbhadrasan), Sitting Asanas ( Vajrasan, padmasan, suptavajrasan, Ardhamaschendrasan, vakrasan), Supine Asanas (Sarvangasan, Matsyasan, Natarajasan, Shavasan) **08 Hours**

### Module – II

**Patanjali's Yoga Sutra:** Eight limbs of yoga, Importance of discipline in Yoga, Stillness of mind, Five Modulations (vritti) of the mind, Practice and Dispassion, Obstacles in the path of Yoga, Overcoming distractions of the mind through Yoga. **08 Hours**

### Module – III

Understanding physiological implications of Yoga, Three types of Gunas (Satva, Rajas and Tamas) and their effects on body and mind, Food Habits, Meaning of Prana, Pranayama and its advantages, Different types of Pranayama. **08 Hours**

### Module – IV

**Ayurveda:** The science of life, Three types of doshas (Vata, Pitta and Kapha), Balancing the different doshas for a healthy life, Ayurvedic principles of food and activity, Advanced Asanas: Mayurasana, Sirsasana, Gomukh Asana, Vrkshasana, Baddha Konasana. **08 Hours**

## Module – V

**Meditation:** Meaning of meditation, Meditation vs Concentration, Advantages of Meditation, Effects of Meditation on body and mind, Effect on health and general well being, Reducing stress through meditation, Increasing concentration, Improving communication, Effect on Environment **08 Hours**

### Course Outcomes:

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

- Know the basic principles of Yoga.
- Know and practice the basic asanas and their benefits.
- Use Pranayama and Meditation for improving health and mental peace.
- Know the difference between meditation and concentration.
- Apply the principles of Ayurveda and implement them for one's benefit.

### Text Books:

1. Yoga Sutras of Patanjali (ancient text).
2. B K S Iyengar: "Light on Yoga".

### Reference Books:

1. A traditional touch to Yogasanas for beginners and Sadhakas, Swami Vivekananda Yoga Prakashana (SVYP).
2. Dr. Vasant Lad: "Ayurveda: The Science of Self-Healing: A Practical Guide".

# Martial Arts

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE663 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

The following types of Martial arts are offered,

1. Karate
2. Taekwondo
3. Judo
4. Kung-fu

Expert Trainers will be provided during the academic year through experts in Martial Arts. Students who enroll for this elective should attend the regular Training classes and maintain a minimum of 85% attendance.

At the end of the training programme the performance Evaluation will be made by team of experts. Students who secure at least a satisfactory grade will be issued a certificate and deemed to have been completed the above said 3 Credit course. However, the students who have shortage of attendance will be consider for the award of 3 credits provided they undergo training at any of the training centers in the above said Martial Arts, complete the certification programme and give a demo along with viva in the presence of experts in the campus.

# Music (Carnatic Vocal/Instrumental)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE664 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Get familiarized with the conceptual understanding of Carnatic music.
- Gain knowledge about the basics of Swaravalis.
- Understand the use of different Talas.
- Gain understanding about various Raagas.
- Gain understanding about intricacies of Swaras.

## Syllabus

### Module – I

**Theoretical Aspects:** Father of Carnatic music, Famous personalities in Carnatic music, Concept of Sapta Swara, Taala, Melody, Pitch, Rhythm, Janaka Raaga, Janya Raaga. **03 Hours**

### Module – II

Sarale Varase (Any 5), Janti Varase (Any 5), Daatu Varase, Tara Stayi, Mandra Stayi. **08 Hours**

### Module – III

**Alankaras:** Druva Taala, Matya Taala, Triputa Taala, Rupaka Taala, Jampe Taala, Atta Taala, Eka Taala. **08 Hours**

### Module – IV

Geethagalu, Pillari Geethe (4), Sanchari Geethe (5), Lakshana Geethe (1). **10 Hours**

### Module – V

Swarajatis (Any 2), Kalyani, Bilahari, Neelambari, Kamach.
Varna (Any 2), Shankarabarana, Kalyani, Hamsadwani , Mohana. **10 Hours**

## Course Outcomes:

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

- Gain knowledge about the theoretical background of carnatic music
- Acquire practical knowledge on basics of Carnatic music.
- Practical demonstration of different Talas.
- Distinguish among various Raagas based on swara sthanas.
- To synchronize the Raaga and Taala.

## Text books:

1. Dr. Sachidevi: “Karnataka Sangeetha Darpana”, Sreenivasa Prakashana, Bengaluru, 2014.
2. Junior Carnatic Music – C Shiva Musicals, Malleshwaram, Bengaluru, 2013.

# Dance (Bharatanatya)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE665 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Gain theoretical knowledge about various types of Indian dances.
- Understand about various musical instruments used in Bharatanatya.
- Learn Practical demonstrations of Bharatanatya steps on Prarthane Namaskara and Shlokas.
- Learn the movements of head, neck, eyes, hands according to Bharatanatya steps.
- Learn the brisk movements in Bharatanatya with the help of ADAVUS.

## Syllabus

### Module – I

Indian Classical dance, It's history and Significance, Types of Classical Dance, Bharatanatya, Kathakali, Mohini Attam, Koochipudi, Katahak, Odissi, Manipuri.

**04 Hours**

### Module – II

Musical Instuments used in Bharatanatya: Tabala, Mrudanga, Kamsale, Kolata, Taala vadya. Famous personalities in Bharatanatya, Composers of Natya Grantas.

**03 Hours**

### Module – III

Practical exercises on Prarthane, Namaskara and Shloka, Vyayama Kriye for Bharatanatya (Two Shlokas and Two Prarthanes). **10 Hours**

### Module – IV

Abhinaya Steps (Chaturvidha) ShiroBedha, Drushti Bedha, Greeva Bedha, Brubedha, Hasta Bedha ( Samyuta and Asamyuta). **10 Hours**

### Module – V

Adavugalu (DashaVidha) Tattu adavu, Mettu Adavu, Nat Adavu, Egaru Tattu Adavu, Egaru Mettu adavu, Jaaru Adavu, Mandi adavu, TattuMettu Adavu, Rangakarma Adavu, Teermana Adavu. **12 Hours**

## Course Outcomes:

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

- Get an insight into various types of Indian dances.
- Gain knowledge of different instruments used to perform dance.
- Perform exercises on prarthane, Namaskara according to Bharatanatya style.
- Perform basic steps in Abhinaya.
- Recognise and perform different Adavus.

## Reference Book:

1. "Bharatanatya shastra", Department of Public Instruction, Karnataka State Government.

# Sports

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE666 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

Students who are selected by the University to represent the VTU teams and for participating at State level / National level Sports in the following sports are exempted from taking open elective (Code:15HOE666 ) and will be awarded 3 credits.

| Outdoor games | Indoor games |
|---|---|
| Cricket | Carrom |
| Foot ball | Chess |
| Hockey | Shuttle Badminton |
| Basket Ball | Squash |
| Kabbadi | Table – Tennis |
| Kho – Kho | Gymnastics |
| Hand – Ball | |
| Athletics | |
| Swimming | |
| Lawn Tennis | |

The achievement in Sports as said above should have been made during the academic year during which the said open elective is offered.

After representing at VTU / State / National level in any of the above said sports, the students should produce the certificates from the competent authorities. Based on the certificates the institution will issue another certificate related to the achievement and awarding of three credits.

# Detailing of Structural Elements Lab

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL67 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Gain knowledge on building drawing in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.
- Impart the basic knowledge of Analysis of different views of Structures.

## Syllabus

### Building Drawing:

Use of commercially available software for the drawing of RCC and Steel Structures

i. Combined Footing
ii. Retaining Wall
iii. Portal frame
iv. Truss
v. Plate girder
vi. Gantry girder

## Course Outcomes:

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

- Execute computer aided drawing for detailing different structural components.
- Develop working drawing for structural fabrication based on design.
- Set up a drawing of different components which are useful for the industries.
- Interpret and Analyze views of a drawing.

## Text Books:

1. Dr. M.N.Shesha Prakash, Dr. G.S.Suresh: “Computer Aided Design Laboratory”, Lakshmi Publications.
2. M.A. Jayaram, D.S. Rajendra Prasad : “CAD Laboratory”, Sapna Publications Learning.
3. James D. Bethune: “Essentials of Drafting”, Prentice-Hall publication, 1977, ISBN-13: 9780132844307.

## Reference Books:

1. Ashok, Kumar Jain: "Reinforced Concrete Limit State Design", Nem Chand Brothers, 1990.
2. Varghese: "Limit state design of concrete", Oxford IBH, 2000.
3. N Subramanian: "Design of steel structures", Oxford University Press, 11th Edition, 2013, ISBN: 9780195676815.
4. Duggal: "Limit State Design of Steel Structures", (Tata Mcgraw Hill, 2010, ISBN: 9781259083785.
5. Lab manual provided by Dept. of Civil Engg., NCET.

## E-Resources:

1. https://www.autodesk.com/solutions/cad-software

# Extensive Survey Camp

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL68 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to : :

- Learn how the new project should be started and the work carried out to complete the project.
- Learn how to calculate the earth work for Embankment and Filling.
- Learn how to set a horizontal curve on a highway alignment.
- Understand the use of total station in all the projects.

## Syllabus

An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days).

The student shall submit a project report consisting of designs and drawings.

**1. General instructions:** Reconnaissance of the sites and fly leveling to establish bench marks.

**2. New Tank Projects:** The work shall consist of

i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.

ii) Capacity surveys.

iii) Details at Waste weir and sluice points.

iv) Canal alignment

**3. Restoration of an Existing Tank:** The work shall consist of:

i) Alignment of centre line of the existing bund, Longitudinal and Cross sections along the centre line.

ii) Capacity surveys, Details at sluice and waste weir.

**4. Water Supply and Sanitary Project:** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.

**5. Highway Project:** Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road. (Drawing should be preferably done using AutoCAD).

## Course Outcomes:

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

- Gain a basic understanding of the principles and operation of the Global Positioning System for locating salient features by Total Station.
- Gain the ability to measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork for civil engineering projects.
- Appreciate the need for licensed surveyors to establish positioning information for property and structures.

## Text Books:

1. Dr. B C Punmia: "Surveying Volume I", (Chapters 1-4, 6,7,9-13,16,18,22), Lakshmi Publications Pvt. Ltd., 6th Edition, 2005, ISBN: 978-81-700-8853-0.
2. Dr. B C Punmia: "Surveying Volume II", (Chapters 1-4,6,7,15), Lakshmi Publications Pvt Ltd, 6th Edition, 2005, ISBN: 978-81-700-8853-0.

## Reference Books:

1. Chandra, A.M.: "Higher Surveying", New Age International Publishers, 2002, ISBN: 9788122438123.
2. Punmia P.C.: "Surveying", Volume 3, 15th Edition, Laxmi publications, 2004, ISBN: 81-7008-825-9.
3. Lab manual provided by Dept. of Civil Engg., NCET.

## E-Resources:

1. http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790
2. http://ascelibrary.org/journal/jsued2
3. www.survivorlibrary.com/engineers_surveying_instruments_1892.pdf
4. www.asicivilsurvey.com/
5. https://www.slideshare.net/suryaom/advance-surveying-equipments

# Technical Aptitude and GD

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVH69 | 2:0:0:0 | 2 | CIE:50 SEE:50 | 3 Hours | HSS |

The respective branches shall conduct training programmes related to important and latest programming languages and other emerging technologies, such as Solar and Electric power based gadgets, IoT, ROBOT's, Environmental friendly and cost effective construction techniques, UAV's and technologies pertaining to the respective department.

# Seventh Semester B.E. – Syllabus
# Geotechnical Engineering-II (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT71 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

- Understand the significance of investigation of soil in the field and various methods to carry on the investigation.
- Understand the seepage conditions and stresses that develop in the soil.
- Understand how to calculate the lateral pressures that develop in the soil.
- Analyze and predict the possible instability of slopes, how to make them stable.
- Appreciate the most important parameter called SBC of soils, which is used while designing the shallow foundations of structures.

## Syllabus

### Module - I

**Subsurface Exploration:** Importance of exploration program, Methods of exploration: Boring, sounding tests. Types of samples - undisturbed, disturbed and representative samples, Samplers, sample disturbance, area ratio, Recovery ratio, clearances, stabilization of boreholes – Typical bore log. Number and depth of borings for various civil engineering structures. **08 Hours**

### Module – II

**Seepage Analysis:** Laplace equation (no derivation), assumptions and limitations only. Flow nets characteristics and applications. Flow nets for sheet piles and below the dam section. phreatic line (Casagrande's method - with toe filter).

**Stresses in Soils:** Boussinesq's and Westergard's theories – assumptions and limitations, Equations for concentrated, circular and rectangular loads. Comparison of Boussinesq's and Westergard's. Pressure bulb. Newmark's chart and its application. **08 Hours**

### Module – III

**Lateral Earth Pressure:** Active and Passive earth pressures, Earth pressure at rest, Earth pressure coefficient. Earth pressure theories- Rankine's and Coulomb's theories – assumptions and limitations, Lateral earth pressure in cohesive and cohesion-less soils. Graphical solutions for active earth pressure (cohesion-less soil only) – Culmann's and Rebhann's graphical methods. **08 Hours**

## Module – IV

**Stability of Earth Slopes:** Types of slopes, causes of failure and type of failure of finite slopes. Definition of factor of safety, stability of infinite slopes, Stability of finite slopes by - Method of slices, Friction Circle method and Taylor's stability number.

**Foundation Settlement:** Calculation of settlement - immediate, consolidation and secondary settlements (no derivations), differential settlement, tilt, permissible settlements and tilts as per B.I.S. – Matrices. **08 Hours**

## Module-V

**Bearing Capacity of Shallow Foundations:** Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's bearing capacity equations-assumptions and limitations, IS Code's bearing capacity equations, Bearing capacity of footings subjected to eccentric loading. Effect of ground water table on bearing capacity. Field methods of evaluation of bearing capacity – Plate load test, Standard penetration test and cone penetration test **08 Hours**

| Lab Session | Topic for a Session (3 Hours) | Tests/Assignments/ Tutorials |
|---|---|---|
| 1 | Specific gravity of soil grains. | Soil identification and record |
| 2 | Field density test (Core cutter and sand replacement methods). | Density test, record |
| 3 | Grain size distribution Sieve analysis. | Soil identification and record |
| 4 | Determination of moisture – Density relationship using Standard Proctor test and Modified Proctor test | Density and water content, record |
| 5 | Permeability determination (Constant head and falling head methods). | Seepage calculation, record |
| 6 | Determination of shear strength parameters:<br>a) Direct shear test on cohesion less soil.<br>b) Unconfined compression test on cohesive soil.<br>c) Triaxial compression test. | Shear parameters calculation, Identification of soil, record |

| | | |
|---|---|---|
| 7 | Determination of the bearing capacity of soil for three different sites. | Calculation of SBC |
| 8 | Demonstration of one dimensional consolidation test (Determination of co-efficient of consolidation only). | Identifying instruments and record |
| 9 | Demonstration of miscellaneous equipments such as Augers, Samplers, rapid Moisture meter, proctor's needle and Vane shear test. | Identifying instruments and record |

**Course Outcomes:**

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

- Analyze any field situation with the knowledge gained.
- Estimate the stresses that will develop in the soil.
- Solve any practical problems related to soil stresses estimation, and seepage including flow net diagram.
- Solve the lateral pressure by different methods.
- Carry out stability analysis and settlement calculation andSolve the SBC of the soil.

**Text Books:**

1. Terzaghi. K. and Peck. R.B.: "Soil mechanics in Engineering practice", 2nd Edition, John Wiley and Sons, New York , 1996, ISBN: 978-0471086581.
2. Punmia B.C.: "Soil Mechanics and Foundation Engg.", 16th Edition, Laxmi Publications Co., New Delhi, 2005, ISBN: 978-8170087915.
3. Gopal Ranjan, Rao A.S.R.: " Basic and Applied Soil Mechanics",New Age International (P) Ltd., New Delhi, 2000, ISBN: 978-8122412239.
4. Venkatramiah C.: "Geotechnical Engineering", New Age International (P) Ltd. Publishers, New Delhi, 2006, ISBN: 978-8122433517.

**Reference Books:**

1. Bowles J.E. (2012), 'Foundation Analysis and Design"' 5th Edition, McGrawHill Pub. Co. New York, 2012, ISBN: 978-1259061035.
2. Bowles J.E.: "Engineering Properties of Soil and their Measurements", McGraw Hill Book Co., New York, 1988, ISBN: 978-0070067516.

4. Craig R.F.: "Soil Mechanics", 7th Edition, Spon press, New York, 2004, ISBN: 978-0415327022.
5. Head K.H.: "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London, 1986, ISBN: 978-0727313058.
6. Lambe T.W.: "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi, ISBN: 978-8126539918.
7. Terzaghi. K. and Peck. R.B.,"Soil mechanics in Engineering practice", 3rd Edition, John Wiley and Sons, New York, 1996, ISBN: 978-0471086581.
8. Alam Singh and Chowdhary G.R.: " Soil Engineering in Theory and Practice", CBS Publishers and Distributors Ltd., New Delhi, 2009, ISBN: 978-8123900391.

**E-Resources:**

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil_mech/index.htm
2. http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html
3. http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf elearning.vtu.ac.in/06cv64

# Estimation and Evaluation (IC)

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVI72 | 3:0:2:0 | 4 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to :

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

## Syllabus

### Module – I and II

**Estimation:** Study of various drawings with estimates, important terms, units of measurement, abstract Methods of taking out quantities and cost – centre line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – RCC framed structures with flat, sloped RCC roofs with all Building components. **16 Hours**

### Module – III

**Estimates:** Manhole and Septic tanks. Specifications, Contracts: Types of contract — essentials of contract agreement —legal aspects, penal provisions on breach of contract. **08 Hours**

### Module – IV

**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, centring and form work for different RCC items. **08 Hours**

### Module – V

**Measurement of Earthwork for Roads:** Methods for computation of earthwork – cross sections – mid section formula or average end area or mean sectional area, trapezoidal and Prismoidal formula with and without cross slope.

**08 Hours**

| Sl. No. | Module | Practical Exercises |
|---|---|---|
| 1 | I | Interpret civil engineering drawings |
| 2 | I | List of various items to be provided to learn the modes of measurements according to prevailing IS 1200 |
| 3 | II | Estimate in detail for load bearing structure, RCC retaining wall, RCC culverts, etc. |
| 4 | III | Collect specifications for at least 10 items of construction work |
| 5 | IV | Analyze rate for at least 10 items of residential building construction. |

**List of Software:**

i. MS Project

ii. Microsoft Excel

**Course Outcomes:**

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

- Explain types of estimate and duties of an Estimator.
- Undertake rate analysis of civil engineering works.
- Determine the rates of various items of civil works.
- Calculate estimated cost of civil construction projects.
- Evaluate the actual value of any property.

**Text Books:**

1. B. N. Dutta: "Estimating and costing", UBS publishers Distributors Ltd., India, 27th Edition, ISBN-13: 978-8174767295.
2. P.L. Basin: "Quantity Surveying", 3rd Revised Edition, S. Chand and company, New Delhi, ISBN-10: 8121900859.
3. S.C. Rangwala: "Estimating and Specification", 16th Edition, Charotar publishing house, 2014, ISBN: 978-93-80358-97-0.

**Reference Books:**

1. G.S. Birde: "Text book of Estimating and Costing", 6th Edition, Dhanpath Rai and sons, New Delhi, ISBN: 9789384378134.
2. D.D. Kohli, R.C. Kohli: "A text book on Estimating, Costing and Accounts", 2nd Edition, S. Chand, New Delhi, ISBN-10: 8121903327.

**E-Resources:**

1. https://www.schandpublishing.com/books/...textbook-estimating-costing.
2. nfra.eresourceerp.com/estimation.html
3. nfra.eresourceerp.com/Project-estimation.html
4. https://www.mynewsdesk.com/in/view/pressrelease/job-costing-estimation

# Construction Industry Practice-III

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT731 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Know principles of safety and good practices of Civil Engineering.
- Implement the principles of Durability,
- Learn Quality control and sustainability of buildings.

## Syllabus

### Module - I

**Innovation / Creativity / Leadership / Team Work** **08 Hours**

### Module – II

**Good practices of civil engineering and safety requirements** **08 Hours**

### Module – III

**Durability of structure / NDT.** **08 Hours**

### Module – IV

**Quality assurance / Quality control** **08 Hours**

### Module – V

**Sustainability and green building** **08 Hours**

## Course Outcomes:

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

- Gain the knowledge about detailing of Structural elements.
- Develop creativity and leadership qualities.
- Acquire the knowledge about good practices and safety requirement of Buildings.
- Gain the information about durability of buildings.
- Obtain the knowledge about quality control and sustainability of buildings.

# Pre-Stressed Concrete Structures

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT732 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Understand the concept of pre stressing, devices and pre and post tensioning.
- Understand the analysis of the stresses due to pre stress and the imposed load.
- Understand the calculation of loss of pre stress and deflections in PSC members.
- Understand the limit state of PSC beams in flexure and shear, and anchorage zone stress.
- Understand the design of pre and post tensioned simple PSC beams.

## Syllabus

### Module - I

**Introduction:** Definition and scope of pre stressed concrete, its applications, High strength concrete and steel, Stress-Strain characteristics and properties.

**Basic Principles of Prestressing:** Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages. **08 Hours**

### Module – II

**Analysis of Sections for Flexure:** Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles. **08 Hours**

### Module – III

**Losses of Pre-Stressing:** Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force. **08 Hours**

### Module – IV

**Limit State of Collapse:** Flexure -IS Code recommendations –Ultimate flexural strength of sections Shear -IS Code recommendations, shear resistance of sections, shear reinforcement. Limit state of serviceability –control of deflections and cracking.

**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 end blocks-Methods, I.S. Code, provision for the design of end block reinforcement. **08 Hours**

## Course Outcomes:

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

- Recognize the basic concepts of principles of dynamics.
- Solve the problems connected with analysis of various structural components.
- Analyze the given frames by suitable method.
- Evaluate the continuous beams by suitable methods.
- Analyze the truss elements by matrix method.

## Text Books:

1. Krishna Raju N.: "Pre-stressed Concrete", 5th Edition, Tata McGraw Hill, New Delhi, 2007.
2. Dayaratnam P.: "Pre-stressed Concrete Structures", Oxford and IBH Publications, New Delhi, 1996.

## Reference Books:

1. Mallick S. K., Gupta A. P.: "Pre-stressed Concrete", Oxford and IBH, New Delhi, 1983.
2. Lin T.Y., Ned. Burns H.: "Design of Pre-stressed Concrete Structures", John Wiley and Sons, New York, 1982.
3. Natarajan V.: "Fundamentals of Pre-Stressed Concrete", 1976, BIP, Bombay.
4. Libby J.R.: "Modern Pre-stressed Concrete", CBS Publishers, New Delhi, 1986.
5. IS:1343-1980, Code of Practice For Prestressed Concrete, Bureau of Indian Standards, New Delhi, 1981.

## E-Resources:

1. http://www.vtuupdates.com>vtunotes
2. http://www.vidhayarthiplus.com
3. http://www.iitg.ernet.in>qip>cd_cell>chapters

# Pavement Design

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT733 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | FE |

## Course Objectives:

This course will enable students to :

- Understand the concepts of pavement components in flexible and rigid pavement.
- Understand the ability to focus on the basic fundamental elements of pavements.
- Understand the concepts of stress strain in flexible pavements based on the layered elastic and viscoelastic solutions.
- Understand the ability to identify, formulate the stresses and deflections in rigid pavements.
- Understand the concepts of joints in rigid pavements and its design concepts.

## Syllabus

### Module - I

**Introduction:** Desirable characteristics of pavement, types and components, Difference between Highway pavement and Air field pavement – Design strategies of variables – Functions of sub-grade, sub base – Base course – surface course – comparison between Rigid and flexible pavement. **08 Hours**

### Module – II

**Fundamentals of Design of Pavements:** Design life – Traffic factors – climatic factors – Road geometry – Subgrade strength and drainage, Stresses and deflections, Boussinesqs theory – principle, Assumptions – Limitations and problems on above - Busmister theory – Two layered analysis – Assumptions – problems on above.

**08 Hours**

### Module – III

**Design of Flexible Pavements:** Empirical methods of Group index method, Plate load test, CBR method – Testing as per IRC, AASHTO, CRV method –Design of pavement by Equivalent C-Value and R-Value method, Triaxial test– Kansas method, McLeod's method, Burmisters layered system concepts and Numerical on above

**08 Hours**

### Module – IV

**Stresses in Rigid Pavement:** Principle – Factors - wheel load and its repetition – properties of sub grade – properties of concrete. External conditions – joints – Reinforcement – Analysis of stresses – Assumptions – Westergaard's Analysis –

Modified Westergaard equations – Critical stresses – Wheel load stresses, Warping stress – Frictional stress – combined stresses (using chart / equations) - problems on above. **08 Hours**

## Module – V

**Design of Rigid Pavement:** Design of C.C. Pavement by IRC: 38 – 2002 for dual and Tandem axle load – Reinforcement in slabs – Requirements of joints – Types of joints – Expansion joint – contraction joint – warping joint – construction joint – longitudinal joint, Design of joints, Design of Dowel bars, Design of Tie bars – problems of the above. **08 Hours**

### Course Outcomes:

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

- Apply the knowledge of pavement components in flexible and rigid pavement.
- Know the basic fundamental elements of pavements.
- Evaluate the stresses and strains in flexible pavements.
- Apply the knowledge to identify and formulate the stresses and deflections in rigid pavements.
- Utilize the design concepts of joints and rigid pavements.

### Text Books:

1. Khanna, Justo: “Highway Engineering”.
2. L R Kadiyalli, N B. Lal: “Principles and Practices of Highway Engineering”.
3. Yang H. Huang: “Pavement Analysis and Design”, 2nd Edition.
4. Relevant IRC codes Reference books:

### E-Resources:

1. www.virginiadot.org/business/resources/bu-mat-pde-aashtoforconsultants0503.pdf
2. pressholland-pub2017.hol.es/pavement-design-vtu-notes.pdf
3. http://nptel.ac.in/downloads/105101087/
4. elearning.vtu.ac.in/
5. ISBN-13: 978-8185240770 Nem Chand andBros; 10th Edition 2015 Edition (2001)
6. ISBN-13: 978-8174091659 Khanna Publisher (1 December 2004)
7. ISBN: 9788131721247 Pearson Edition: 2008

# Fire Safety and Management

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT741 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Provide an in-depth knowledge about the science of fire.
- Understand the causes and effects of fire.
- Know the various fire prevention systems and protective equipments.
- Understand the science of explosion and its prevention techniques.
- Understand the various fire prevention techniques to be followed in a building..

## Syllabus

### Module - I

**Basic Physics and Chemistry Related to Fire:** Fire properties of solid, liquid and gases - fire spread - toxicity of products of combustion - theory of combustion and explosion – vapour clouds – flash fire – jet fires – pool fires – unconfined vapour cloud explosion, shock waves - auto-ignition – boiling liquid expanding vapour explosion.

**07 Hours**

### Module – II

**Fire Prevention and Protection:** Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E- Fire extinguishing agents- Water ,Foam, Dry chemical powder, Carbon-dioxide- Halon alternatives Halocarbon compounds Inert gases , dry powders – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – lay out of stand pipes – fire station-fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills – notice-first aid for burns. **07 Hours**

### Module – III

**Industrial Fire Protection Systems:** Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. **07 Hours**

### Module – IV

**Building Fire Safety:** Objectives of fire safe building design, Fire load, fire resistant material and fire testing – structural fire protection – structural integrity – concept of egress design - exit – width calculations - fire certificates–fire safety requirements for high rise buildings. **07 Hours**

## Module – V

**Explosion Protecting Systems:** Principles of explosion-detonation and blast waves-explosion parameters – Explosion Protection, Containment, Flame Arrestors, isolation, suppression, venting, explosion relief of large enclosure explosion venting-inert gases, plant for generation of inert gas rupture disc in process vessels and lines explosion, suppression system based on Carbon dioxide (CO2) and halons-hazards in LPG, Ammonia (NH3). **07 Hours**

## Course Outcomes:

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

- Make familiar about basic concepts of fire and explosion science.
- Know the different source of ignition and their prevention techniques.
- Operate the various types of fire fighting equipments.
- Differentiate the causes and prevention of explosion.
- Equip the students to effectively employ explosion protection techniques and their significances to suit the industrial requirement.

## Text Books:

1 Derek, James: "Fire prevention Handbook", Butter worths and company, London, 1986.

2. Arthur E Cote: "Fire protection handbook", nfpa, 2008.

3. Jain V K: "Fire safety in building", New age international, 1996.

4. Purandare D D, Abhayd Purandare: "Handbook on Industrial fire safety", Panda publications, New Delhi, 2006.

## Reference Books:

1. Gupta, R.S.: "Hand Book of Fire Technology", Orient Blackswan, 2010.
2. McElroy, Frank E: "Accident Prevention manual for industrial operations", N.S.C., Chicago, 1988.
3. Dinko Tuhtar: "Fire and explosion protection – A System Approach" Ellis Horwood Ltd. Publisher, 1989.
5. "Fire fighters hazardous materials reference book", Van Nostrand 60 Rein Hold, New York, 1993.
6. Dennis P. Nolan: "Handbook of Fire and Explosion Protection Engineering Principles for Oil, Gas, Chemical, and Related Facilities", William Andrew Publishers, 1996.
7. James G. Quintiere: "Fundamentals of Fire Phenomena", John Wiley and Sons Ltd., England, 2006.

## E-Resources:

1. www.ind-safety.com
2. www.firesafety

# Fundamentals of Energy, Environment and Climate Change

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT742 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

## Course Objectives:

This course will enable students to :

- Understand the Earth's Energy Budget, Environment and the processes leading to climate change.
- Understand the inter-relatedness of the Terrestrial Energy-Environment-Climate System.
- Understand the perturbing effects of anthropogenic activities on this system.
- Understand the meaningful climate change quantification, and thence the means of ameliorating adverse climate change impacts.

## Syllabus

### Module – I

**Overview:** on the Earth's energy requirement vis-à-vis Climate Change. Origins of the terrestrial atmosphere. Earth's early atmosphere. Introduction to Climate. Layers of the atmosphere. Composition of the present day atmosphere. Post Industrial Revolution Scenario. **08 Hours**

### Module – II

**Energy Balance:** Earth –Atmosphere System. Solar and Terrestrial Radiation. Absorption of Radiation by gases. Energy balance. Solar variability and the Earth's Energy Balance –Basic concepts only. **08 Hours**

### Module – III

**Atmospheric Chemistry and Climate:** The Global Temperature Record. Green House Gas theory. Possible effects of Global Warming – Indian Context. The Ozone depletion problem. Atmospheric Aerosol and Cloud Effects on Climate. **08 Hours**

### Module – IV

**Environmental Variability:** Natural and Anthropogenic. Effects of urbanization, Landscape changes, Influence of Irrigation, Desertification and Deforestation. **08 Hours**

### Module – V

**Equipment for Production of Alternative Materials:** Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements. **08 Hours**

## Course Outcomes:

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

- Acquire a basic understanding of the terrestrial eco-system comprising of 3 principal components: Energy, Environment and Climate change.
- Comprehend a global picture of the inter-relatedness of the Energy-Environment-Climate system.
- Assess as qualified professionals, the perturbing effects of human activities on the earth's climate.
- Acquire the necessary skills to predict emerging climate change trends globally as well as within the Indian Subcontinent.
- Acquire the requisite professional skills to undertake policy decisions on the use and efficient management of the Earth's resources.

## Text Books:

1. Jill Jaeger: "Climate and Energy Systems. A review of their interactions", John Wiley, 1983.
2. "Policy interventions to promote energy efficient and environmentally sound technologies in SMI", Asian Institute of Technology, 2002, ISBN: 974-8209-01-6.

## E-Resources:

1. www.springer.com/br/book/9789027727688
2. onlinelibrary.wiley.com/doi/10.1002/j.1477-8696.1989.tb04972.x/pdf
3. onlinelibrary.wiley.com/doi/10.1029/2003GL018206/full

# Industrial Waste Water Treatment

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVT743 | 3:0:0:0 | 3 | CIE:50 SEE:50 | 3 Hours | EE |

**Course Objectives:**

This course will enable students to :

- Identify, formulate, and solve various types of industrial pollution.
- Function on multi-disciplinary teams in the areas of different types of industries to reduce, recycle and reuse the waste from industries.
- Apply knowledge of mathematics, science, and engineering in industrial waste water treatment, like planning, analysis and designing of treatment units including details of statuary rules and regulations.
- Design a system, components, or processes to meet desired needs in industrial waste water treatment.
- Identify, various types of industrial wastes and suitable treatment techniques.

**Syllabus**

## Module - I

Industrial scenario in India - Industrial activity and Environment - Uses of Water by industry - Difference between domestic and industrial wastewater- Parameters of pollution and their effects receiving streams- Classification of streams based on the mixing of effluents-Self-purification of streams - Oxygen sag curve- Derivation of streeter – phelps equation – Numerical problems **08 Hours**

## Module – II

Environmental standards for industrial effluents - Effluent sampling – grab and composite sampling, Treatment methods of industrial effluent – pretreatment of waste - Equalization – Neutralization-Flotation-Volume reduction and strength reduction. **07 Hours**

## Module – III

Introduction to Secondary treatment of industrial effluents – Design of an aeration unit – design of a trickling filter – design of an oxidation pond - Introduction and feasibility of combined treatment municipal waste and industrial waste -volume ratio -Rental charges and economics. **07 Hours**

## Module – IV

Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Cotton textile Industry, Dairy industry and Sugar Mill. **07 Hours**

## Module – V

Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Paper and pulp Industry, Distillery industry, Food Processing industry. Processing industry. **07 Hours**

### Course Outcomes:

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

- Characterize the different types of industrial effluents.
- Advise the regulating authority about the possible danger specific industries.
- Develop planning skill in designing water pollution control systems in industries.
- Differentiate red category industries from green category industries.
- Characterize the different effluents from specific industries.

### Text Books:

1. Nelson L Nemerow: "Liquid Waste of industry, Theories, Practices and Treatment", Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
2. Rao M N, Dutta A.K: "Waste water treatment", 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.

### Reference Books:

1. Mahajan S P.: "Pollution control in Process Industries", Tata McGraw Hill Company, New Delhi, 1985, ISBN: 9780074517727, 0074517724.
2. Eckenfelder: "Industrial Water pollution Control", McGraw Hill Company, New Delhi American Chemical Society, Washington D.C., USA, 2000, ISBN: 9789339220433.

### E-Resources:

1. www.neerienvis.nic.in/pdf/
2. www.fao.org/
3. www.gewater.com/applications
4. www.waterleau.com/en

# Tax Management

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE751 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Familiarise the students with the significance of taxation system.
- Understand the structure of Indian Taxation system.
- Gain knowledge about the practical aspects of Indian taxation.
- Understand the system of computation of tax from Salaries.
- Sketch the recent trends in Indian taxation system.

## Syllabus

### Module – I

Introduction to taxation system, Objectives of taxation, Factors to be considered for tax planning Canons of taxation, Types of taxation, Direct tax, Indirect tax (Broad perspective only). **07 Hours**

### Module – II

Taxation system in India, Types of taxes levied in India, Various heads of income tax (Broad outline only} Basic concepts in taxation, Assessment year, Financial year, assessee, Residential status, Tax liability **08 Hours**

### Module – III

Income tax authorities in India, Constitution, Powers, Functions specimen of Form 16, Filing of returns, tax evasion, Penalties for contravening the provisions of income tax. **08 Hours**

### Module – IV

System of computation of tax from salaries, Taxable income, Permissible deductions from 80C to 80U Fringe benefits exempted from tax, exempted income under section 10 of Income tax act. **10 Hours**

### Module – V

Trends in Indian taxation system, Self assessment, PAN card, Budgetary provisions of the financial year 2017-18 on taxation, GST, Advantages, Problems in implementing GST, Measures to overcome the limitations of GST. **06 Hours**

## Course Outcomes:

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

- Gain knowledge about the system of taxation prevailing in the country.
- Compute tax under different heads.
- Gain practical knowledge on filing returns.
- Calculate the payable tax for salaried individuals.
- Gain insight into recent practices on taxation.

## Reference Books:

1. Dr. Vinod K. Singhania: “Direct taxes-Law and Practice”, Taxmann Publication.
2. Dr. Mehrotra, Dr. Goyal: “Direct taxes- Law and Practice”, Sahitya Bhavan Publication.
3. “7 lectures-Income tax-I “, VBH.
4. Swaminathan: “Income Tax”, KPH.
5. T.N.Manoharan: “Income tax including VAT”.
6. R.G.Saha, Ushadevi: “Taxation”, HPH.

# Assessment of Building Energy Performance

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE752 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

**Course Objectives:**

This course will enable students to:

- Provide a foundation for performing a building energy audit.
- Perform assessment tasks on building energy performance.
- Submit a Building EQ rating.
- Understand the methods and processes to be performed in the field.
- Know the process of certifying professionals in energy assessment.

**Syllabus**

## Module – I

Introduction, global energy consumption characteristics and the role of commercial and residential buildings, building energy end use consumption characteristics, impact of time variations in building energy consumption, Building mechanical, electrical, and lighting systems. **08 Hours**

## Module – II

Anatomy of typical HVAC systems in commercial buildings, typical primary and secondary HVAC equipment and their role in meeting system requirements, basics of electrical distribution systems and their equipment in commercial buildings, basics of lighting system in buildings, including performance terminology, lighting technologies, energy performance, and the role of day lighting. **08 Hours**

## Module – III

Introduction to building energy benchmarking and assessment, differences between benchmarking, labeling programs, and energy and environmental auditing, role of building type and climate zone on energy use, key aspects of ENERGY STAR® Portfolio Manager and other tools for benchmarking, ASHRAE Building EQ As Designed and In Operation ratings, differences between Building EQ and Portfolio Manager, Preliminary Energy Use Analysis (PEA). **08 Hours**

## Module – IV

Measuring and monitoring building performance, instrumentation for measuring indoor environmental quality and building energy flows, Perform measurements of indoor environmental quality and building energy flows, accuracy of building measurements, Identify the components of an ASHRAE Level 1 walk through survey and the differences between Level 1, 2, and 3 surveys, Indoor Environment Quality. **08 Hours**

## Module – V

Energy Efficiency Measures – Building Envelope and Lighting, role of building envelope characteristics on energy use, energy conservation and energy efficiency measures related to envelope and lighting characteristics, Energy Efficiency Measures – HVAC Systems, energy conservation and energy efficiency measures related to HVAC systems, financial analysis of expected improvements to HVAC systems. **08 Hours**

### Course Outcomes:

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

- Produce an ASHRAE Building EQ In Operation rating for the buildings provided in the class.
- Produce a listing of potential Energy Efficiency Measures (EEM) including financial payback analysis.
- Perform measurements of indoor environmental quality and HVAC system performance.
- Identify different building types and determine the impact of climate on energy use.
- Analyze raw energy consumption data from measured-meter readings.

### Text Books:

1. ASHRAE Building Energy Quotient Program website.
2. ASHRAE BEAP certification study guide.
3. ASHRAE Standard 105-2014 Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emission.

### Reference Books:

1. ASHRAE Performance Measurement Protocols for Commercial Buildings: Best Practices Guide.
2. ENERGY STAR® Portfolio Manager website.

# Natural Disaster Mitigation and Management

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE753 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Understand about types of natural and environmental disasters.
- Develop skills in various stages of disaster preparedness, mitigation and management.
- Understand the methodologies for disaster risk assessment.

## Syllabus

### Module – I

**Natural Disasters – Overview:** Introduction- Natural Disasters around the world- Natural Disaster Risk Assessment- Earth and its characteristics Human Dimensions of Global environment Change – Disaster mitigation, preparedness, response and recovery comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs. **08 Hours**

### Module – II

**Natural Hazards:** Introduction and Review - Natural Disasters - Principles, Elements, and Systems- Geological-Geomorphological aspects, Earthquake- Geology, Seismology, Characteristics and dimensions – Landslides - Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc.- Tsunami - Nature and characteristics. **08 Hours**

### Module – III

**Climate system aspects and Processes:** Oceanic, Atmospheric and Hydrologic cycles - Severe Weather and Tornadoes , Cyclones, Floods and Droughts - Global Patterns - - Mitigation and Preparation – Drought – Famine- nature and dimensions – Drought Assessment and Monitoring. **08 Hours**

### Module – IV

**Natural Disaster Communication:** Mapping - Modeling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies ( ICT ) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination, mobile communication – etc. **08 Hours**

## Module – V

**Administrative mechanisms:** Community and Social organizations – Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self education. **08 Hours**

### Course Outcomes:

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

- Learn about the types of natural and environmental disasters and its causes.
- Learn about organizational and Administrative strategies for managing disasters.
- Learn about the early warning systems, monitoring of disasters effect and necessity of rehabilitation.
- Learn about the engineering and non-engineering controls of mitigating various natural disasters.
- Apply the key roles of capacity building to face disaster among government bodies, institutions, NGO's, etc.
- Learn methodologies for disaster risk assessment with the help of latest tools like GPS, GIS, Remote sensing, information technologies, etc.

### Text Books:

1. Kovach, Robert L.: "Earth's Fury: An Introduction to Natural Hazards and Disasters", Englewood Cliffs, N.J., Prentice Hall, 1995.
2. Siddhartha Gautam, K Leelakrishna Rao: "Natural disaster Management", 3rd Edition, 2012, ISBN: 9381604320.

### Reference Book:

1. Arul Jothi, D L Balaji: "Safety and Disaster Management Education In Schools", 1st Edition, Anmol Publications, 2009, ISBN: 9380252609.

### E-Resources:

1. https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/dsstr.../bt-dsstr-mtgtn-en.aspx
2. www.nrdms.gov.in/natural_disaster.asp
3. https://www.ncbi.nlm.nih.gov › NCBI › Literature › Bookshelf

# Small and Medium Enterprise Management

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE761 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Understand the various concepts of Entrepreneurship and familiarize them with the understanding of contemporary environment of MSMEs.
- Understand the business Environment to MSMEs.
- Understand the process of Enterprise Creation.
- Understand the effective Business Plan and Institutional Support Mechanism.
- Understand the concepts of marketing management in the MSMEs.

## Syllabus

### Module – I

**Basic Aspects:** Concept, nature of Entrepreneur and Entrepreneurship, Distinction between Entrepreneur and Manager, Entrepreneurship, Medium, Small and Tiny Business : Definition, Role in the economy and significance, Changing scenario of MSMEs in the era of Liberalization and Globalization, Competitiveness. **08 Hours**

### Module-II

**Environment assessment:** Political, Legal, Economic, Social, Technological, Global environment, Assessment of business opportunities, Government initiatives and private sector opportunity. **08 Hours**

### Module-III

**Enterprise Creation**: Starting a small industry, Entrepreneurial function or process of starting a new venture based on personal competencies, requirements to start a business venture, Feasibility of the project, Business incubators . **08 Hours**

### Module-IV

**Business Plan:** Developing effective business plan-meaning, benefits of business plan, Timing of the business plan, Length of the business plan, composition of the business plan or detailed project report. Institutional Support Mechanism: District Industries Centre, State Directorate of Industries, SIDBI, NSIC, SISI, KSFC, KIADB, TECSOK. **08 Hours**

## Module-V

**Small Business Marketing:** Concept of Marketing, Scope of Marketing, Marketing Mix, Product Mix, Channels of Distribution, Market Segmentation, Role of Middlemen, Distribution Strategies, Sales Promotion, Advertising and Publicity, Packaging Strategies, Branding Strategies. **08 Hours**

### Course Outcomes:

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

- Visualize the various concepts of Entrepreneurship and understand of current environment of MSMEs.
- Know the Business Environment with respect to MSMEs.
- Know the Process of Enterprise Creation.
- Prepare Business Plan and Understand the Institutional Support Mechanism.
- Know the marketing management with reference to MSMEs.

### Text Books:

1. Shukla. M.B: "Entrepreneurship and Small Business Management", Kitab Mahal, Allahabad, 2011.
2. Sahay A., V. Sharma: "Entrepreneurship and New Venture Creation", Excel Books, New Delhi, 2008.
3. Lall, Sahai: "Entrepreneurship", Excel Books, New Delhi, 2006.
4. S. Anil Kumar: "Small Business and Entrepreneurship", I.K.International Publishing House Pvt. Ltd., 2008.
5. Kotler, Keller, Koshy, Jha: "Marketing Management", 13th Edition, Pearson Education.

### Reference Book:

1. Wickham, Phillip A: "Strategic Entrepreneurship", Pitman, UK, 1998.

# Occupational Safety and Health Administration

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE762 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

## Course Objectives:

This course will enable students to :

- Understand the occupational health and safety and sector specific occupational health and safety issues.
- Understand the socio-economic aspects of occupational health and safety.
- Understand the health screening measures.
- Understand the legal Provisions on Occupational Health and Safety.
- Understand the participatory Research and Occupational Health.

## Syllabus

### Module – I

**Introduction to Occupational Health and Safety:** Definition and Context of OHS, Objectives and Principles of OHS, Workplace and Health Occupational Health, Hygiene and Ergonomics.

**Sector Specific Occupational Health and Safety Issues:** Health and Safety Risks in Mining, Health Hazards in Electronic Industry, Health Hazards in Food Processing Industry, Health Hazards in Other Industries. **07 Hours**

### Module – II

**Socio-Economic aspects of Occupational Health and Safety:** Women's occupational and health safety, Child labour issues in occupational health and safety, Health issues in the unorganized sector.

**Basics of Preventive Techniques:** Definition of Accident, Accident Analysis, Monitoring of Hazards, Reporting and Investigation of Accidents. **08 Hours**

### Module – III

**Health Screening Measures:** Stages of Medical Examination, Occupational History, Pulmonary Function Test (PFT), Noise Induced Hearing Loss (NIHL). **07 Hours**

### Module – IV

**Legal Provisions on Occupational Health and Safety:** Overview of existing OHS Legislations in India, The Factories Act, The Mines Act, The Workmen's Compensation Act, The Employee's State Insurance Act. **07 Hours**

### Module-V

**Participatory Research and Occupational Health:** Philosophy of Participatory Research (PR) Analysis based on PR Methodologies Conducting Participatory Research for OHS. **07 Hours**

**Course Outcomes:**

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

- Develop the ability to know the occupational health and safety.
- Have the knowledge of the socio-economic aspects of occupational health and safety.
- Demonstrate purpose of health screening measures.
- Know the legal Provisions on Occupational Health and Safety.
- Participate in Research and Occupational Health.

## References:

1. International Labour Organinization. Mining: a hazardous work [Internet]. ; 2015 ([cited 2015 Feb 2]. Available from: http://www.ilo.org/safework/areasofwork/hazardous-work/WCMS_124598/lang--en/index.htm
2. Gyekye, S.A. Workers' perceptions of workplace safety: an African perspective. Int J Occup Saf Ergon. 2006;12:31–42.Crossref | PubMed| Scopus (4)
3. Amponsah-Tawiah, K., Jain, A., Leka, S., Hollis, D., Cox, T. Examining psychosocial and physical hazards in the Ghanaian mining industry and their implications for employees' safety experience. J Safety Res. 2013;45:75–84.Crossref PubMed| Scopus (5)
4. Owiredu D. Annual chamber of mines presidential review. 83rd Annual General Meeting of the Ghana Chamber of Mines [Internet]. 2011 [cited 2014 Mar 1]. Available from:http://www.ghanachamberofmines.org.
5. Helliwell, J.F., Putnam, R.D. The social context of wellbeing. Philos Trans R Soc Lond B Biol Sci. 2004;35:1435–1446.Crossref| Scopus (550)
6. Bhagawati, B. Basics of occupational safety and health. IOSR J Environ Sci Toxicol Food Technol. 2015;9:91–94.
7. Amponsah-Tawiah, K., Dartey-Baah, K. Occupational health and safety: key issues and concerns in Ghana. Int J Bus Soc Sci. 2011;14:120–126.

   National Safety Council. Injury facts. NSC, Itasca (IL); 2004.

# Animation and Multimedia Engineering

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15HOE763 | 2:0:0:4 | 3 | CIE:50 SEE:50 | 3 Hours | OE |

**Course Objectives:**

This course will enable students to:

- Understand the basics of Animation.
- Understand computer animation using characters.
- Learn how to create quality animation characters.
- Learn about volume construction and action made from face, gestures.
- Understand Acting and Sketching techniques.

**Syllabus**

## Module – I

**Introduction to Animation:** History of Animation, The Origins of Animation, Types of Animation, Terms used in Animation, Basic Principles of Animation.

**Introduction to equipment required for Animation:** Animator's Drawing Tools, Rapid Sketching and Drawing, Developing Animation Character. **07 Hours**

## Module – II

**Developing the characters with computer animation:** Anatomy and Body Language, 2-D virtual drawing for animation.

**Motion studies:** : Thumbnails, sequential movement drawing, drawing for motion. **08 Hours**

## Module – III

**Essentials and qualities of good animation characters:** Three dimensional drawings of characters.

**Skills and Basic proportions:** Visual and creative development of an artist, how to draw gestures, Heads, Rotation in Arcs, Key Lines, Perspective. **08 Hours**

## Module – IV

**Volume Construction:** Balance, Muscles, Light and shade.

**Shape and Action:** Hands and Legs, Foreshortening, Facial expressions. **08 Hours**

## Module – V

**Acting and Sketching techniques:** Introduction to Acting, Modeling, Sketching from Acting, Sketching from live models, Introduction to Rapid Sketching Techniques, Sketching from Memory, live action. **09 Hours**

## Course Outcomes:

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

- Recognize the basics of animation along the tools.
- Develop characters with computer animation.
- Develop 3D drawings of characters and acquire skills regarding basic level of sketching.
- Explain Foreshortening, Facial expressions.
- Develop small animation characters by using acting and sketching techniques.

## Text Books:

1. Chris Patmore: "The Complete Animation course: The Principles, Practice and Techniques of Successful Animation", (Chapters 1-10), Barons Educational Series New York, 2003, ISBN-13: 978-0764123993.

## Reference Books:

1. Frank Thomas, Ollie Johnston: "The Illusion of Life by Walt Disney", Abbeville Press, 1981.
2. Daniel Carter, Michael Courtney: "Anatomy for the Artist: A Comprehensive Guide to Drawing the Human Body, A Complete Guide", 2011.

## E-Resources:

1. http:// www.animationmentor.com/
2. https://www.bloopanimation.com/animation-for-beginners/
3. https://robots.thoughtbot.com/css-animation-for-beginners

# Project Management Lab

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL77 | 0:0:2:0 | 1 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to:

- Understand the principles of construction project management.
- Prepare work break down plan and estimate resources required in a construction project.
- Prepare precedence diagram and network diagrams.
- Implement resource allocation and levelling using MSP.
- Prepare the reports using MSP.

## Syllabus

1. Preparing Calendar for project.
2. Create Task and its relationship.
3. Planning and Scheduling the resources.
4. Creating work break down structure.
5. Preparing the resource sheet.
6. Assign and levelling the resource.
7. Time Estimate for activities.
8. Earned value.
9. Tracking.
10. Filters and groups.
11. Calculation for residential building.

## Course Outcomes:

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

1. Prepare project plans, schedule of construction.
2. Utilize the concept of construction project management in software.
3. Analyze construction project techniques using PERT and CPM networks.
4. Allocating the resource in construction project management using software.
5. Create the construction project reports.

## Text books:

1. Peurifoy. R L: "Construction Planning, Equipment and Methods", McGraw Hill,8 th Edition, ISBN-10: 0073401129.
2. Chitkara K K: "Construction Project Management", Tata McGraw Hill, 3rd Edition, ISBN: 9789339205454.
3. Srinath L.S: "PERT and CPM", East West Press Pvt. Ltd., New Delhi, ISBN-13: 978-8185336206.

## Reference Books:

1. Harry G Harris and Gajanan M Sabnis: "Structural Modeling and Experimental Techniques", 2nd Edition, ISBN: 0849324696.
2. Lab manual provided by Dept. of Civil Engg., NCET.

## E-Resources:

1. www.youtube.com/watch?v=iABaMkWtuPw
2. support.office.com/en-us/article/Set-the-general...
3. www.wrike.com/blog/project-manager-calendar
4. www.tacticalprojectmanagement.com/ms-project-export

# Analysis and Design Lab–II

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVL78 | 1:0:2:0 | 2 | CIE:50 SEE:50 | 3 Hours | FC |

## Course Objectives:

This course will enable students to:

- Different types of FEM software in Civil Engineering.
- Impart the basic knowledge of Analysis of different components of Structures.
- Impart the knowledge of spread sheet in solving Civil Engineering Problems.

## Syllabus

Use of commercially available FEM software for the analysis and design of

- **Multistorey Building**
  - i. Residential Building
  - ii. Commercial building
- **Industrial Building**
  - i. Truss
  - ii. Girder

**Use of Excel sheets in Civil Engineering Problems.**

Use of spread sheet for the following civil engineering problems,

- **Regression analysis for rainfall and runoff relation**
- **Determination of**
  - i. Grain size analysis
  - ii. Density of soil
  - iii. Shear parameters of soil

## Course Outcomes:

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

- Design and Analysis of Different components of Structures.
- Apply Spreadsheet calculations to Civil Engineering.
- Analyze water resource networks.

- Apply computing skills to geotechnical engineering.
- Make use of various software package.

**Text Books:,**

1. Dr. M.N. Shesha Prakash, Dr. G.S. Suresh: "Computer Aided Design Laborator", Lakshmi Publications.
2. Ramesh Bangia: "Excel 2002", Khanna Book Publishing Co. (P) Ltd., Microsoft, ISBN-10: 8187522577, ISBN-13: 978-8187522577, Mathieson SA -Excel, Starfire Publishers.

**Reference Books:**

1. Ragunath. H.M.: "Hydrology", Wiley Eastern, 1990, ISBN: 93-220-0880-6.
2. Punmia, B.C.: "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 1995, ISBN-13: 9788170087915.
3. Ashok, Kumar Jain: "Reinforced Concrete Limit State Design", Nem Chand Brothers, 1990, ISBN: 9788131802410.
4. N Subramanian: "Design of steel structures", Oxford University Press, 11th Edition, 2013, ISBN: 9780195676815.
5. Duggal: "Limit State Design of Steel Structures", Tata Mcgraw Hill, Edition, 2010, ISBN: 9781259083785.
6. Lab manual provided by Dept. of Civil Engg., NCET.

**E-Resources:**

1. https://www.scribd.com/doc/148477559/staad-pro-manual-pdf
2. https://www.google.co.in/webhp?ei=amQ6Wdn1C8TevgTd0rsw&yv=2&rct=j#
3. https://www.google.co.in/webhp?ei=amQ6Wdn1C8TevgTd0rsw&yv=2&rct=j#
4. https://www.google.co.in/webhp?ei=amQ6Wdn1C8TevgTd0rsw&yv=2&rct=j#

# Project Phase–I

| Course Code | L:T:P:S | Credits | Exam marks | Exam Duration | Course Type |
|---|---|---|---|---|---|
| 15CVP79 | 1:0:4:0 | 3 | CIE:50 SEE:50 | 3 Hours | FC |

| Phase | Activity | Credits |
|---|---|---|
| I | Batch formation, project identification, literature survey, finalization of problem statement with objectives and outcomes, Synopsis submission, Preliminary seminar for the approval of selected topic and objectives. | 3 |

# Eighth Semester B.E. – Syllabus

| Phase | Activity | Credits |
|---|---|---|
| II | Design, Theoretical/experimental investigation and Mid-term seminar to review the progress of the work and documentation(Mid term report) | 4 |
| III | Completion of the project work, participation in the project exhibition, Submission of project report Final Internal seminar and demonstration, Publications | 4 |
| | Evaluation and Viva voce | 5 + 5 |

# Program Educational Objectives (PEOs)

Civil engineering graduates are expected to fulfill the following PEOs after few years of their graduation.

| | |
|---|---|
| **PEO1** | Graduates in Civil Engineering will apply the technical knowledge for sustainable societal growth. |
| **PEO2** | Graduates of civil Engineering will demonstrate designing,modeling and analyzing skills. |
| **PEO3** | Graduates in Civil Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection |
| **PEO4** | Civil Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values. |
| **PEO5** | Civil engineering graduates will have the ability to become entrepreneurs thereby switching over from responsive engineering to creative engineering. |

# Program Outcomes (POs)

| | |
|---|---|
| **PO1** | **Engineering Knowledge:** Apply knowledge of mathematics and science, Engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering. |
| **PO2** | **Problem Analysis:** Identify, Formulate, review research literature and analyze complex Civil Engineering problems and reaching substantiated conclusions using first principles of mathematics and engineering sciences. |
| **PO3** | **Design/ Development of solutions:** Design solutions for complex Civil Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations. |
| **PO4** | **Conduct Investigations of Complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions related to Civil Engineering problems |

| | |
|---|---|
| **PO5** | **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, FEM, GIS, etc. including prediction and modeling to complex Civil Engineering activities with an understanding of the limitations. |
| **PO6** | **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Civil Engineering practice. |
| **PO7** | **Environment and Sustainability:** Understand the impact of the professional Civil Engineering solutions in societal and environmental contexts and demonstrate the knowledge and the need for sustainable development. |
| **PO8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Civil Engineering practice. |
| **PO9** | **Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings. |
| **PO10** | **Communication:** Communicate effectively on complex Civil Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO11** | **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Civil Engineering projects and in multidisciplinary environments. |
| **PO12** | **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |