KARNATAK LAW SOCIETY'S

# GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

**(APPROVED BY AICTE, NEW DELHI)**

## Department of Civil Engineering

## Scheme and Syllabus
## (2016 Scheme)
## Semester III - VIII

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for III Semester B. E. during 2018-19 [Regular Students]**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16MAT31 | Statistical – Numerical – Fourier Techniques | BS | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 2 | 16CV32 | Fluid Mechanics | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 3 | 16CV33 | Strength of Materials | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 4 | 16CV34 | Concrete Technology | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV35 | Basic Surveying | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 6 | 16CVL36 | Strength of Materials Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 7 | 16CVL37 | Concrete Technology Laboratory | PC | 0 | 0 | 3 | 3 | 2 | 25 | 25 | 50 |
| 8 | 16CVL38 | Basic Surveying Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **27** | **24** | **325** | **325** | **650** |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for III Semester B. E. during 2018-19 [Lateral Entry Students]**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16DIPMAT31 | Calculus, Fourier Analysis and Linear Algebra | BS | 4 | 1 | 0 | 5 | 5 | 50 | 50 | 100 |
| 2 | 16CV32 | Fluid Mechanics | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 3 | 16CV33 | Strength of Materials | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 4 | 16CV34 | Concrete Technology | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV35 | Basic Surveying | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 6 | 16CVL36 | Strength of Materials Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 7 | 16CVL37 | Concrete Technology Laboratory | PC | 0 | 0 | 3 | 3 | 2 | 25 | 25 | 50 |
| 8 | 16CVL38 | Basic Surveying Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **28** | **25** | **325** | **325** | **650** |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for IV Semester B. E. during 2018-19 [Regular Students]**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16MATMC41 | Partial Differential Equations and Sampling Techniques | BS | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 2 | 16CV42 | Advanced Surveying | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 3 | 16CV43 | Building Materials and Construction Technology | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 4 | 16CV44 | Analysis of Determinate Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV45 | Hydraulics and Hydraulic Machines | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 6 | 16CVL46 | Advanced Surveying Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 7 | 16CVL47 | Hydraulics and Hydraulic Machines Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 8 | 16CVL48 | Building Planning and Drawing Laboratory | PC | 1 | 0 | 4 | 5 | 3 | 50 | 50 | 100 |
| 9 | 16CV49A | Design Thinking and Innovation | HS | 0 | 0 | 2 | 2 | 2 | 50 | -- | 50 |
| 10 | 16CV49B | Environmental Studies | HS | 1 | 0 | 0 | 1 | MNC | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **30** | **25** | **425** | **375** | **800** |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for IV Semester B. E. during 2018-19 [Lateral Entry Students]**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16DIPMATM41 | Vector Calculus, Laplace Transforms and Probability | BS | 4 | 1 | 0 | 5 | 5 | 50 | 50 | 100 |
| 2 | 16CV42 | Advanced Surveying | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 3 | 16CV43 | Building Materials and Construction Technology | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 4 | 16CV44 | Analysis of Determinate Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV45 | Hydraulics and Hydraulic Machines | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 6 | 16CVL46 | Advanced Surveying Lab | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 7 | 16CVL47 | Hydraulics and Hydraulic Machines Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 8 | 16CVL48 | Building Planning and Drawing Laboratory | PC | 1 | 0 | 4 | 5 | 3 | 50 | 50 | 100 |
| 9 | 16CV49A | Design Thinking and Innovation | HS | 0 | 0 | 2 | 2 | 2 | 50 | -- | 50 |
| 10 | 16CV49B | Environmental Studies | HS | 1 | 0 | 0 | 1 | MNC* | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **31** | **26** | **425** | **375** | **800** |

MNC* Mandatory Non credit Course

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for V Semester B. E. during 2019-20 [Regular Students]**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | **16CV51** | Management and Entrepreneurship | HS | 4 | 0 | 0 | 4 | 4 | 50 | 50 | 100 |
| 2 | 16CV52 | Analysis of Indeterminate Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 3 | 16CV53 | Design of RCC Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 4 | 16CV54 | Highway and Airport Engineering | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV55 | Hydrology and Irrigation Engineering | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 6 | 16CV56X | Elective-I | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 7 | 16CVL57 | Highway Engineering Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 8 | 16CVL58 | Computer Aided Design and Drawing Laboratory | PC | 0 | 0 | 3 | 3 | 2 | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **28** | **26** | **350** | **350** | **700** |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for V Semester B. E. during 2019-20 [Lateral Entry Students]**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16DIPMATM51 | Partial Differential equations, Z-Transforms and Stochastic Processes | BS | 4 | 1 | 0 | 5 | 5 | 50 | 50 | 100 |
| 2 | 16CV51 | Management and Entrepreneurship | HS | 4 | 0 | 0 | 4 | 4 | 50 | 50 | 100 |
| 3 | 16CV52 | Analysis of Indeterminate Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 4 | 16CV53 | Design of RCC Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV54 | Highway and Airport Engineering | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 6 | 16CV55 | Hydrology and Irrigation Engineering | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 7 | 16CV56X | Elective-I | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 8 | 16CVL57 | Highway Engineering Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 9 | 16CVL58 | Computer Aided Design and Drawing Laboratory | PC | 0 | 0 | 3 | 3 | 2 | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **33** | **31** | **400** | **400** | **800** |

**List of Electives**

| **Elective –I ( V Semester)** | | |
|---|---|---|
| **Sl.No.** | **Subject** | **Subject Code** |
| **1** | Theory of Elasticity | 16CV561 |
| **2** | Open Channel Hydraulics | 16CV562 |
| **3** | Air Pollution and Control | 16CV563 |
| **4** | Traffic Engineering | 16CV564 |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for VI Semester B. E. during 2019-20**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16CV61 | Soil Mechanics | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 2 | 16CV62 | Railways, Tunnels, Harbors and Docks | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 3 | 16CV63 | Water Supply Engineering | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 4 | 16CV64 | Design of Steel Structures | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 5 | 16CV65X | Open Elective-II | OE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 6 | 16CVL66 | Extensive Survey Project / Laboratory | PC | 1 | 0 | 4 | 5 | 3 | 50 | 50 | 100 |
| 7 | 16CVL67 | RCC Design and Drawing Laboratory | PC | 1 | 0 | 4 | 5 | 3 | 50 | 50 | 100 |
| 8 | 16CVL68 | Hydraulic Structures Design and Drawing Laboratory | PC | 1 | 0 | 4 | 5 | 3 | 50 | 50 | 100 |
| 9 | 16CV69 | CIP, Professional Ethics & Human Values | HS | 2 | 0 | 0 | 2 | 2 | 25 | 25 | 50 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Total Academic Engagement and Credits | | | | | | | 34 | 28 | 425 | 425 | 850 |

**List of Electives**

| **(Open) Elective-II (VI Semester)** | | |
|---|---|---|
| **Sl.No.** | **Subject** | **Subject Code** |
| **1** | Numerical methods | 16CV661 |
| **2** | Optimization Techniques | 16CV662 |
| **3** | Environmental Impact Assessment | 16CV663 |
| **4** | Remote Sensing and GIS | 16CV664 |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for VII Semester B. E. during 2020-21**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16CV71 | Geotechnical Engineering | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 2 | 16CV72 | Quantity Surveying and Valuation | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 3 | 16CV73 | Waste Water Engineering | PC | 3 | 1 | 0 | 4 | 4 | 50 | 50 | 100 |
| 4 | 16CV74X | Elective-III | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 5 | 16CV75X | Elective-IV | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 6 | 16CVL76 | Structural Steel Design and Drawing Laboratory | PC | 1 | 0 | 4 | 5 | 3 | 50 | 50 | 100 |
| 7 | 16CVL77 | Geotechnical Engineering Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 8 | 16CVL78 | Environmental Engineering Laboratory | PC | 0 | 0 | 2 | 2 | 1 | 25 | 25 | 50 |
| 9 | 16CV79 | Seminar on Project Synopsis | **PR** | 0 | 0 | 2 | 2 | 2 | **25** | **--** | **25** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | **29** | **25** | **375** | **350** | **725** |

**List of Electives**

| Elective –III ( VII Semester) | | |
|---|---|---|
| **Sl.No.** | **Subject** | **Subject Code** |
| **1** | Matrix Method of Structural Analysis | 16CV741 |
| **2** | Structural Dynamics | 16CV742 |
| **3** | Advanced Design of RC Structures | 16CV743 |
| **4** | Reinforced Earth Structures | 16CV744 |
| **5** | Ground Water Hydrology | 16CV745 |
| **6** | Ground Improvement Techniques | 16CV746 |
| **7** | Solid Waste Management | 16CV747 |
| **8** | Pavement Materials and construction | 16CV748 |

| Elective –IV ( VII Semester) | | |
|---|---|---|
| **Sl.No.** | **Subject** | **Subject Code** |
| **1** | Finite Element Analysis | 16CV751 |
| **2** | Bridge Engineering | 16CV752 |
| **3** | Earthquake Resistant Structures | 16CV753 |
| **4** | Advanced Foundation Design | 16CV754 |
| **5** | Industrial Waste Water treatment | 16CV755 |
| **6** | Pavement Design | 16CV756 |
| **7** | Design of Prestressed Concrete | 16CV757 |
| **8** | Construction Management and Equipments | 16CV758 |

**CIVIL ENGINEERING**
**KLS GOGTE INSTITUTE OF TECHNOLOGY, UDYAMBAG, BELAGAVI-8**
**[Batch Joining during 2017-18]**
**Scheme of Teaching for VIII Semester B. E. during 2020-21**

| Sr. No. | Course Code | Course | | Contact Hours | | | Total Contact Hours/week | Total Credits | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | CIE | SEE | Total |
| 1 | 16CV81 | Internship | INT | | | | -- | 2 | 50 | -- | 50 |
| 2 | 16CV82 | Intellectual Property Rights & Cyber Law | HS | Self Study | | | -- | 2 | 50 | -- | 50 |
| 3 | 16CV83 | Professional Certificate Course -I | CC | | | | -- | 1 | 25 | -- | 25 |
| 4 | 16CV84 | Professional Certificate Course - II | CC | | | | -- | 1 | 25 | -- | 25 |
| 5 | 16CV85 | Minor Project on Social Responsibility | HS | 0 | 0 | 2 | 2 | 1 | 25 | -- | 25 |
| 6 | 16CV86 | Project Phase -1 | PC | | | | -- | 2 | 50 # | -- | 50 |
| 7 | 16CV87 | Project Phase -2 | PC | | | | -- | 4 | 50 # | -- | 50 |
| 8 | 16CV88 | Project Phase -3 (Final Viva-voce) | PC | 0 | 0 | 2 | 2 | 7 | -- | 100 | 100 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Total Academic Engagement and Credits** | | | | | | | | **20** | **275** | **100** | **375** |

# Project Phase-1 and 2: CIE- 50 Marks (25 Marks for Guide + 25 marks for Presentation)

## SEMESTER III

## STATISTICAL – NUMERICAL – FOURIER TECHNIQUES

**(Common to all Branches)**

## (FOR REGULAR STUDENTS)

| | | | |
|---|---|---|---|
| **Course Code** | 16MAT31 | **Credits** | 04 |
| **Course type** | BS | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course Learning Objectives(CLOs)**

1. Learn Numerical methods to solve Algebraic, Transcendental and Ordinary Differential Equations.
2. Understand the concept of Fourier series and apply when needed.
3. Get acquainted with Fourier Transforms and its properties.
4. Study the concept of Random variables and its applications.
5. Get acquainted with Joint Probability Distribution and Stochastic processes.

**Pre-requisites :**

1. Basic Differentiation and Integration
2. Basic Probabilities
3. Basic Statistics

### UNIT I

**Numerical solution of Algebraic and Transcendental equations**

Method of false position, Newton- Raphson method (with derivation), Fixed point iteration method (without derivation).

**Numerical solution of Ordinary differential equations**

Taylor's Series method, Euler and Modified Euler method, Fourth order Runge–Kutta method

**08 Hours**

### UNIT II

**Fourier Series**

Convergence and Divergence of Infinite series of positive terms (only definitions). Periodic functions. Dirichlet's conditions, Fourier series, Half range Fourier sine and cosine series. Practical examples, Harmonic analysis.

**08 Hours**

### UNIT III

**Fourier transforms**

Infinite Fourier Transform and Properties. Fourier Sine and Cosine Transforms Properties and Problems.

**08 Hours**

### UNIT IV

**Probability**

Random Variables (RV), Discrete and Continuous Random variables (DRV, CRV), Probability Distribution Functions (PDF) and Cumulative Distribution Functions(CDF), Expectations, Mean, Variance. Binomial, Poisson, Exponential and Normal Distributions. Practical examples.

**08 Hours**

### UNIT V

**Joint PDF and Stochastic Processes**

Discrete Joint PDF, Conditional Joint PDF, Expectations (Mean, Variance and Covariance). Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.

**08 Hours**

**Text Books**


1. B. S. Grewal, **" Higher Engineering Mathematics" ,** Khanna Publishers, 42nd Edition, 2012.
2. P. N. Wartikar and J. N. Wartikar, **"Applied Mathematics (Volume I and II)"** , Pune Vidyarthi Griha Prakashan, 7th Edition 1994.

3. B. V. Ramana, **" Higher Engineering Mathematics" ,** Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

**Reference Books:**


1. Erwin Kreyszig, **"Advanced Engineering Mathematics",** John Wiley & Sons Inc., 9th Edition, 2006.
2. Peter V. O' Neil, **"Advanced Engineering Mathematics",** Thomson Brooks/Cole, 7th Edition, 2011.
3. Glyn James, **"Advanced Modern Engineering Mathematics"**, Pearson Education, 4th Edition, 2010.


**Course Outcomes (COs)**

| **At the end of the course, the student will be able to:** | **Bloom's Level** |
|---|---|
| 1. **Use** Numerical methods and **Solve** Algebraic, Transcendental and Ordinary differential equations. | **L3** |
| 2. **Develop** frequency bond series from time bond functions using Fourier series. | **L3** |
| 3. **Summarize** Fourier Transforms and its properties. | **L2** |
| 4. **Explain** the concept of Random variables, PDF, CDF and its applications | **L2** |
| 5. **Extend** the basic probability concept to Joint Probability Distribution, Stochastic processes. | **L2** |
| 6. **Apply** Joint Probability Distribution, Stochastic processes to solve relevant problems. | **L3** |

**Program Outcomes (POs)**

| | |
|---|---|
| 1. An ability to apply knowledge of Mathematics, science and Engineering. | **PO 1** |
| 2. An ability to identify, formulate and solve engineering problems. | **PO 5** |
| 3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice. | **PO11** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Black Board Teaching | 1. Internal Assessment |
| 2. Power Point Presentation | 2. Assignment |
| 3. Scilab/Matlab/ R-Software | 3. Quiz |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

Two IA tests are compulsory.
Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

**CALCULUS, FOURIER ANALYSIS AND LINEAR ALGEBRA**

**(Common to all Branches)**

**(FOR LATERAL ENTRY STUDENTS)**

| | | | |
|---|---|---|---|
| **Course Code** | 16DIPMATM31 | **Credits** | 05 |
| **Course type** | BS | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 4–1– 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 50 | **SEE Duration** | 3 Hours for 100 Marks |

**Course Learning Objectives (CLOs)**

1. Learn the concept of series expansion using Taylor's and Maclaurin's series and get acquainted with the polar curves and partial differentiation.
2. Learn Differential Equations of first order and higher order and apply them.
3. Get acquainted with Fourier Transforms and its properties.
4. Learn Numerical methods to solve Algebraic, Transcendental and Ordinary Differential Equations.
5. Explain and interpret the system of equations and various solutions.

**Pre-requisites :**

1. Basic Differentiation and Integration
2. Trigonometry
3. Matrix and Determinant operations
4. Vector algebra

**UNIT I**

**Differential Calculus:** Taylor's and Maclaurin's Theorems for function of one variable (Statement only) - Problems. Angle between Polar curves, Partial Differentiation: Definition and problems. Total Differentiation- Problems. Partial Differentiation of Composite functions-Problems.

**10 Hours**

**UNIT II**

**Differential Equations**

Linear differential equation, Bernoulli's equation, Exact differential equation (without reducible forms) - Problems and Applications (Orthogonal Trajectories, Electrical circuits and derivation of escape velocity). Linear Differential Equation with constant coefficients - Solution of second and higher order Differential Equations, Inverse differential operator method and problems.

**10 Hours**

**UNIT III**

**Fourier Analysis**

Fourier Series: Fourier Series, Half Range Fourier - sine and cosine series. Practical examples. Harmonic analysis.

Fourier Transforms: Infinite Fourier Transform and Properties. Fourier sine and cosine Transforms - Properties and Problems. **10 Hours**

**UNIT IV**

**Numerical Techniques**

Numerical solution of Algebraic and Transcendental equations: Method of false position, Newton-Raphson method (with derivation), Fixed point iteration method (without derivation). Numerical solution of Ordinary differential equations: Taylor's Series method, Euler and Modified Euler method, Fourth order Runge–Kutta met hod (without derivation).

**10 Hours**

## UNIT V

**Linear Algebra**

Rank of a matrix by elementary transformation, Solution of system of linear equations-Gauss Jordan method and Gauss-Seidal method. Eigen values and Eigen vectors – Rayleigh's Power method.

**10 Hours**

**Text Books:**


1. B. S. Grewal, **"Higher Engineering Mathematics"**, Khanna Publishers, 42nd Edition, 2012 and onwards.
2. P. N. Wartikar and J. N. Wartikar, **"Applied Mathematics (Volume I and II"),** Pune Vidyarthi Griha Prakashan, 7th Edition, 1994 and onwards.
3. B. V. Ramana, **Higher Engineering Mathematics" ,** Tata McGraw-Hill Education Private Limited, Tenth reprint, 2010 and onwards.


**Reference Books:**


1. Erwin Kreyszig, **"Advanced Engineering Mathematics" ,** John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
2. Peter V. O' Neil, **"Advanced Engineering Mathematics" ,** Thomson Brooks/Cole, 7th Edition, 2011 and onwards.
3. Glyn James, **"Advanced Modern Engineering Mathematics" ,** Pearson Education, 4th Edition, 2010 and onwards.


**Course Outcomes (COs)**

| | At the end of the course, the student will be able to: | Bloom's Level |
|---|---|---|
| 1. | **Develop** the Taylors and Maclaurins series using derivative concept. | **L3** |
| 2 | **Demonstrate** the concept and use of Partial Differentiation in various problems. | **L2** |
| 3 | **Classify** Differential Equations of First and Higher order and **apply** them to solve relevant problems**.** | **L1 L3** |
| 4 | **Develop** frequency bond series from time bond functions using Fourier series. | **L3** |
| 5 | **Use** Numerical methods and **Solve** Algebraic, Transcendental and Ordinary differential equations | **L3** |
| 6. | **Interpret** the various solutions of system of equations and **Solve them.** | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1. | An ability to apply knowledge of Mathematics, science and Engineering. | **PO 1** |
| 2. | An ability to identify, formulate and solve engineering problems. | **PO 5** |
| 3 | An ability to use the techniques, skills and modern engineering tools necessary for engineering practice | **PO 11** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Black board teaching | 1. Internal Assessment Tests |
| 2. Power point Presentation | 2. Assignments |
| 3. Scilab/ Matlab/ R-Software | 3. Quizes |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of two Assignments/ Mathematical/Computational/ Statistical tools of 4 labs in a semester | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| Two IA tests are compulsory. | | | | | |

Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## FLUID MECHANICS

| | | | |
|---|---|---|---|
| **Course Code** | 16CV32 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1. Describe the properties of fluids, apply the concepts to solve related problems on Newtonian fluids and analyze problems related to fluid at rest including practical applications.
2. Illustrate the basic concepts of pressure and its measurements and demonstrate the principles of mathematics to represent kinematic concepts related to fluid flow.
3. Apply the concept of conservation of mass, conservation of linear momentum, Bernoulli's principle for practical application and outline the various methods of flow measurements
4. Outline the concepts of dynamics of fluid flow in pipes and evaluate the effects of water hammer.
5. Describe the concept of Dimensional analysis and model studies and apply to practical problems.

**Pre-requisites:**

1. Engineering Mechanics

### UNIT I

**Basic properties of fluids**

Introduction, Definition of fluid, Systems of units, properties of fluid: Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Vapour pressure, Bulk modulus of Elasticity and Compressibility, Surface tension and Capillarity.

**Pressure and its measurement**

Definition of pressure, Variation of pressure in a fluid, Pressure at a point, Pascal's law, Types of pressure – Atmospheric pressure, Absolute pressu re, Gauge and Vacuum pressure. Measurement of pressure using simple, differential and inclined manometers (theory and problems)

**08 Hours**

## UNIT II

**Hydrostatic pressure on surfaces**

Total pressure and centre of pressure, total pressure on plane surfaces- horizontal, vertical and inclined surfaces, Pressure diagram, Total pressure on curved surfaces and problems

**Kinematics of flow**

Introduction, methods of describing fluid motion, types of fluid flow, streamline, pathline, streamtube. Three dimensional, two dimensional and one dimensional continuity equation in Cartesian Coordinates (derivation and problems). Velocity and acceleration of fluid particles, Velocity potential and Stream function- problems. Concept of flownet.

**08 Hours**

## UNIT III

**Dynamics of fluid flow**

Introduction, Energy possessed by a fluid body. Euler's equation of motion along a streamline, Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Applications of Bernoulli's equation (with and without losses). Introduction to Kinetic energy correction factor. Concept of momentum equation for pipe bends.

**Discharge measurements**

Introduction, Venturimeter, Orificemeter, Pitot tube, Venturiflume, Triangular notch, Rectangular notch, Cipolletti notch, Ogee weir, Broad crested weir, Small orifices- Problems, Mouthpiece

**08 Hours**

## UNIT IV

**Pipe flow**

Introduction, losses in pipe flow, Darcy-Weisbach equation for head loss due to friction in a pipe. Minor losses in pipe flow, equation for head loss due to sudden expansion and sudden contraction- problems. Pipes in series and pipes in parallel, equivalent pipe-problems. Hydraulic gradient and Energy gradient

**Water hammer**

Water hammer in pipes, equation for pressure rises due to gradual valve closure and sudden closure for rigid and elastic pipes and problems.

**Self Learning Topics**: Hydraulic gradient and Energy gradient. **08 Hours**

## UNIT V

**Dimensional analysis**

Introduction, Dimensions, Dimensional Homogeneity of an equation. Analysis- Rayleigh's method, Buckingham's Π theorem- problems

**Model studies**

Model Studies, Similitude – Types of similarity, No n-dimensional numbers: Problems on Froude model law and Reynolds model law. Types of models: Undistorted and Distorted models, Problems. Scale effect.

**08 Hours**

**Text books:**


1. Modi P. N. and Seth S. M., **"Hydraulics and Fluid Mechanics"** , Standard Book House, New Delhi. 2009 Edition.
2. Rajput R. K., **"A Text Book of Fluid Mechanics and Hydraulic Machi nes"** -, S. Chand and Co, New Delhi, 2006 Edition.
3. Bansal R. K., **"Text Book of Fluid Mechanics and Hydraulic Machine s",** Laxmi Publications, New Delhi, 2008 Edition.
4. Narayana Pillai N., "**Principles of Fluid Mechanics and Fluid Machines"** , Universities Press (India), Hyderabad, 2009 Edition.

**Reference books**:


1. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi**, "Fundamentals of Fluid Mechanics"** , Wiley India, New Delhi, 2009 Edition.
2. Edward J. Shaughnessy, Jr. IraM. Katz, James P. Schaffer**, "Introduction to Fluid Mechanics",** Oxford University Press, New Delhi, 2005 Edition.
3. Streeter Wylie ,**"Fluid Mechanics"** , Bedford New Delhi, 2008(Ed)
4. Madan Mohan Das, **"Fluid Mechanics and Turbo-machines",** PHI Learning Pvt. Limited, New Delhi. 2009 Edition.


**Course Outcomes (COs)**

| **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|
| 1. **Identify** the properties of fluid as a continuum | **L3** |
| 2. **Solve** problems on hydrostatics, including practical applications | **L3 L5** |
| 3. **Demonstrate** the principles of mathematics to represent kinematic concepts related to fluid flow | **L2** |
| 4. **Apply** the fundamental laws of fluid mechanics - conservation of mass, conservation of linear momentum, & the Bernoulli's principle for practical application | **L3** |
| 5. **Outline** and **Propose** the methods of flow measurements | **L2 L6** |
| 6. **Apply** the concept of Dimensional analysis and model studies and **Solve** practical problems | **L3 L6** |

**Program Outcomes (POs)**

| | |
|---|---|
| 1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts | **PO 1** |
| 2. Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO 4** |
| 3. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO 5** |
| 4. Graduates shall possess effective oral and written communication skills | **PO 10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| Two IA tests are compulsory. Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50. | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## STRENGTH OF MATERIALS

| | | | |
|---|---|---|---|
| **Subject Code** | 16CV33 | **Credits:** | 04 |
| **Course Type** | PC | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3-1-0 | **SEE Marks:** | 50 |
| **Total Hours** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Define stresses, strains and elastic constants and relationship between them.
2. Determine the shear force and bending moment in statically determinate beams.
3. Evaluate the bending stresses and shear stresses and plot the stress distribution diagrams.
4. Determine the slope and deflection for beams subjected to various loads.
5. Evaluate the buckling strength of columns and explain the concept of torsion.

**Pre-requisites:**

1. Engineering Mechanics

### UNIT I

**Simple Stresses and Strains**

Introduction to stresses and strains, Hooke's law, Elastic constants, Relationship among Elastic constants, Stress – Strain relationship for structu ral steel, volumetric strain, composite sections, thermal stresses, Compound stresses- general two-dimensional stress system, principal planes and stresses, Mohr's circle

**09 Hours**

### UNIT II

**Axial Force, Shear Force and Bending Moment in Beams**

Axial force, Shear Force and Bending Moment, Relationship between loading, shear force and bending moment, Plotting the AFD, SFD and BMD for cantilever, simply supported and overhanging beams subjected to point loads, UDL, UVL and external moment.

**09 Hours**

### UNIT III

**Bending stresses and Shear stresses in Beams**

Theory of bending, Derivation of equation for bending, Bending stresses in beams, Modulus of Rupture, Section Modulus, Flexural Rigidity, bending stress distribution across the depth of beam.

Shear stresses in beams, Shear Stress distribution diagrams for rectangular, symmetrical 'I' and 'T' sections

**08 Hours**

### UNIT IV

**Deflection of Beams**

Equation for elastic curve, Slope and Deflection for prismatic beams (Simply supported, Overhanging and Cantilever beams) subjected to point loads, UDL and external moment- using

Double Integration method and Macaulay's method

**07 Hours**

## UNIT V

**Elastic Stability of Columns**

Euler's theory for columns, Effective length, Slenderness ratio, Euler's buckling load for standard case (both ends hinged case), Discussion of buckling loads for other end conditions using effective length concept, Rankine's formula.

**Torsion of Circular Shafts**

Assumptions, Derivation of torsion equation for circular shafts, Torsional Rigidity

**Self Learning Topic:** Euler's buckling load for eccentric loading.

**07 Hours**

**Text Books**

1. Bhavikatti S. S., **"Strength of Materials",** Vikas Publishing house Pvt. Ltd, New Delhi
2. Bansal R. K., **"Strength of Materials** ", Laxmi Publications, New Delhi
3. Beer and Johnston, **"Mechanics of Materials",** Tata McGraw Hill

**Reference Books:**

1. Timoshenko and Young, **"Elements of Strength of Materials",** Affiliated East-West Press
2. Basavarajaiah B. S., Mahadevappa P. **"Strength of Materials in SI Units**", University Press (India) Pvt. Ltd., 3rd Edition, 2010
3. James M. Gere, **"Mechanics of Materials",** Thomson Learning
4. Popov E. P., **"Mechanics of Solids",** Prentice Hall of India

**Course Outcomes (COs):**

| **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|
| 1. **Explain** the types of stresses, strains and elastic constants and relation among Them | **L2** |
| 2. **Evaluate** shear force, axial force and bending moment and draw SFD, AFD and BMD | **L3 L4** |
| 3. **Evaluate** the bending and shear stresses and plot the stress distribution Diagrams | **L3 L4** |
| 4. **Analyse** the beams subjected to various loads for Slope and Deflection | **L4** |
| 5. **Evaluate** the buckling strength of columns and explain the concept of torsion | **L3 L4** |

**Program Outcomes (POs)**

| | |
|---|---|
| 1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO 01** |
| 2. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO 05** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

Two IA tests are compulsory.

Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## CONCRETE TECHNOLOGY

| | | | |
|---|---|---|---|
| **Course Code** | 16CV34 | **Credits** | 04 |
| **Course Type** | PC | **CIE Marks** | 50 |
| **Hours/week: L – T – P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course Learning Objectives (CLOs)**

1. To study the properties of different types of cements and chemical admixtures used for construction.
2. To classify the aggregates and study their physical and mechanical properties.
3. To explain the properties of fresh concrete, mix design and quality control.
4. To examine the properties of hardened concrete and illustrate non destructive testing.
5. To illustrate process of concreting, form work for concrete, Guniting, Shotcreting

**Pre-requisites:** Nil

### UNIT I

**Cement**

Cement- Manufacture of Portland cement, types of cement and its chemical composition, hydration of cement, testing of cement: Normal consistency, fineness test, setting time, soundness, strength. Special cements, Construction chemicals

**07 Hours**

## UNIT II

**Aggregates**

Classification of aggregates according to the source, aggregate size and shape, properties of aggregate: physical properties- specific gravity, bulk density, porosity and absorption, moisture content, bulking of sand, mechanical properties- crushing value, abrasion value, impact value

Sieve analysis- fineness modulus and grading curve, combining aggregates, grading requirements as per IS specifications, recycled aggregates

**08 Hours**

## UNIT III

**Fresh concrete**

Properties- factors affecting fresh concrete properties. Tests on fresh concrete- slump, flow tests, compaction factor test and Vee-bee test.

Mix Design- Principles of mix design, grades of concrete, methods of proportioning, trial mixes, Design of concrete mixes using IS: 10262-2009, quality control.

**10 Hours**

## UNIT IV

**Hardened concrete**

Test on hardened concrete- compressive strength, split-tensile strength, flexural strength; Factors affecting the strength of hardened concrete, Modulus of elasticity, Durability of concrete- Permeability, water absorption.

**Self Learning Topics:** Non-destructive testing.

**07 Hours**

## UNIT V

**Concreting operations**

Process and manufacturing of concrete, Mixing, transporting, placing, compacting and finishing; Curing- methods of curing, cold-weather concreting, hot-weather concreting, pre-packed concrete, form work for concrete, Form work for concrete, Guniting, Shotcreting.

**08 Hours**

**Text Books**


1. Shetty M. S., **"Concrete Technology",** S. Chand and Company Ltd., Delhi, 1988.
2. Neville A. M., **"Properties of Concrete",** Longman Scientific & Technical, England, 2000.
3. SanthaKumar A. R., **"Concrete Technology"** , Oxford University Press, New Delhi, 2007


**References**


1. Krishnaraju N., **"Design of Concrete Mixes",** Sehgal Educational Consultants and Publishers Pvt. Ltd., Faridabad, 2002.
2. Gambhir M. L., **"Concrete Technology",** 1995.
3. Varshney. R. S., **"Concrete Technology",** Oxford and IBH Publishers, 1982
4. IS: 10262-2009, **"Recommended Guidelines for Concrete Mix Design"** , 2009


**Course Outcomes (COs)**

| **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|
| 1. **Explain** the properties and tests on cement and aggregates**.** | **L2** |
| 2. **Summarize** the properties of fresh concrete, concrete mix design and quality control tests | **L2 L3** |
| 3. **Explain** the properties of hardened concrete | **L2** |
| 4. **Illustrate** the process of concreting, form work for concrete | **L2** |

**Program Outcomes (POs)**

| | |
|---|---|
| 1. Graduates shall possess the ability to review the research literature and | **PO 2** |

analyze complex engineering problems.

2. Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. **PO 3**
3. Graduates shall be able to design and conduct experiments and interpret the results as per the current research. **PO 4**
4. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. **PO 5**

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |

Two IA tests are compulsory.

Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## BASIC SURVEYING

| | | | |
|---|---|---|---|
| **Subject Code** | 16CV35 | **Credits** | 04 |
| **Course Type** | PC | **CIE Marks** | 50 |
| **Hours/week: L – T – P** | 3– 1 – 0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hour for 100 Marks |

**Course Learning Objectives (CLOs)**

1. Explain the principles of surveying.
2. Discuss the fundamentals of topographical map.
3. Comprehend the steps and computations involved in surveying.

4. Explain the characteristics of contour and methods of contouring.
5. Compute the areas and volumes for civil engineering works.

**Pre-requisites: NIL**

**UNIT I**

**Introduction**

Definition of surveying, Primary divisions of surveying, Basic principles of Surveying, Classification of surveying, Basic Surveying equipments and their application in surveying (Chain, Tape, Arrows, Ranging rod, Offset rod). Units of measurements, Precision and accuracy, Map, Plan, Scale, Direct and Indirect ranging, Setting out of right angles, Types of Chain and Tape, Measurement of distances over sloping ground, Chain and Tape corrections (only linear corrections.)

**06 Hours**

**UNIT II**

**Compass Surveying**

Types of compass, Principle and working of prismatic compass, Comparison between prismatic compass and surveyor's compass, WCB and RB, Types of Meridians and Bearings, Determination of included angles of closed and open traverses.

**Compass Traversing**

Local attraction- determination and correction, Latitude and Departure, Dependent and Independent coordinates, Checks for closed traverse and determination of closing error and its direction.

**10 Hours**

**UNIT III**

**Leveling**

Definition, Objective, Temporary adjustment of dumpy level, Types of levels, Curvature and Refraction corrections, Type of leveling- Differential leveling, Profile leveling, Cross sectioning, Fly leveling and Fly back leveling, Reciprocal leveling, Booking of levels, Rise and Fall method and Height of Instrument method-Numerical problems, Errors in Leveling.

**10 Hours**

**UNIT IV**

**Contours**

Contours and their characteristics, direct and indirect methods, Interpolation techniques, Uses of contours, Capacity contours. Numerical problems, Study of topographic maps.

**06 Hours**

**UNIT V**

**Areas and Volumes**

Calculation of area from cross staff surveying, Methods of determining areas by trapezoidal and Simpson rules, Measurement of volume by prismoidal and trapezoidal formulae. **Self Learning Topics:** Field applications of Area and Volume calculations.

**08 Hours**

**Text Books**


1. Punmia B. C., **"Surveying Vol–1"** , Laxmi Publications, New Delhi
2. Subramanian R., **"Surveying and Leveling"** , Oxford University Press (2007)
3. Venkataramiah C., **"Text Book of Surveying"** Universities Press.(2009 Reprint)
4. Rethaliya R. P, **"Surveying Atul Prakashan"** , Gandhi road, Ahmadabad
5. Kanetkar T. P and Kulkarni S.V, **"Surveying and Leveling Part- I"** , Pune Vidyarthi Ghrih Prakashan


**References**


1. Milton O. Schimidt, **"Fundamentals of Surveying"** , Wong, Thomson Learning
2. Roy S. K., **"Fundamentals of Surveying"** , Prentice Hall of India.
3. Duggal S. K., **"Surveying Vol. I"** , Tata McGraw Hill – Publishing Co. Ltd., New Delhi .

4. Maps, Survey of India Publication

**Course Outcomes (Cos):**

| | **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|---|
| 1. | **Identify** problems and mistakes occurring in field measurements for linear and angular instrument | **L 3** |
| 2. | **Distinguish** between source and types of errors present in surveying measurement and their significance | **L 4** |
| 3. | **Identify** the different types of leveling in civil engineering work | **L3** |
| 4. | **Identify** the area and volumes using contours for different civil engineering projects | **L3** |
| 5. | **Demonstrate** applications of Linear and Angular surveying instruments | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO 1** |
| 2. | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO 5** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |
| Two IA tests are compulsory. Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50. | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## STRENGTH OF MATERIALS LAB

| | | | |
|---|---|---|---|
| **Subject Code** | 16CVL36 | **Credits** | 01 |
| **Course Type** | PC | **CIE Marks** | 25 |
| **Hours/week: L – T – P** | 0-0-2 | **SEE Marks** | 25 |
| **Total Hours** | 26 | **SEE Duration** | 3 Hours for 50 Marks |

**Course Learning Objectives (CLOs)**

1. To illustrate the behavior of the structural steel under the applied loads and study stress-strain behavior and highlight practical applications.
2. To enable students to have hands-on experience on testing and characterize the important building materials by conducting appropriate tests in conformity with the specified IS code procedures.
3. To equip the students to analyze and interpret the results, draw suitable inferences in conformity with specifications, acceptability and utility of the results.
4. Function as a team member to conduct experiments in groups.

**List of Experiments**

**Exp. No. Experiments**

1. Tension test on Mild steel
2. Tension test on HYSD bar
3. Bend-Rebend test on Mild steel
4. Torsion test on Mild steel
5. Single Shear test on Mild steel/ Aluminium
6. Double Shear test on Mild steel/ Aluminium
7. Charpy Impact Test on Mild steel
8. Izod Impact Test on Mild steel
9. Rockwell Hardness test on Mild steel/ Aluminium
10. Brinell Hardness test on Mild steel/ Aluminium
11. Bending test on Timber under two-point loading
12. Compression test on Bricks
13. Water Absorption test on Bricks
14. Flexural test on Tiles
15. Abrasion test on Tiles

**References:**


1. Davis, Troxell and Hawk, **"Testing of Engineering Materials"**, International Student Edition - McGraw Hill Book Co. New Delhi
2. Fenner, **"Mechanical Testing of Materials"** , George Newnes Ltd, London
3. Kukreja C. B., Kishore K., **"Material Testing Laboratory Manual"**, Ravi Chawla Standard Publishers and Distributors 1996
4. Holes K. A., **"Experimental strength of Materials"**, English Universities Press Ltd. London
5. Suryanarayana A. K., **"Testing of Metallic Materials"**, Prentice Hall of India Pvt. Ltd. New Delhi
6. Relevant IS Codes (as applicable for each test).

**Course Outcomes (COs)**

| | At the end of the course, students will be able to: | Bloom's Level |
|---|---|---|
| 1. | **Get acquainted with** the behavior of the structural steel. | **L4** |
| 2. | **Get acquainted with** the behavior of the wooden member subjected to bending and compression. | **L3 L5** |
| 3 | **Characterize** the important building materials by conducting appropriate tests in conformity with the specified IS code procedures | **L2** |
| 4 | **Ascertain** the suitability and applicability of construction materials. | **L3 L5** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall be capable of working productively in team with meaningful contribution as a member and with leadership attributes. | **PO9** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

1. Continuous evaluation of conduct of Practical and Journals
2. Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

1. **Minimum CIE marks required for eligibility for SEE: 13 out of 25**
2. **Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## CONCRETE TECHNOLOGY LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL37 | **Credits** | 02 |
| **Course Type** | PC | **CIE Marks** | 25 |
| **Hours/week: L – T – P** | 0 – 0 – 3 | **SEE Marks** | 25 |
| **Total Hours** | 39 | **SEE Duration** | 3 Hours for 50 Marks |

**Course Learning Objectives (CLOs)**

1. To prepare the students effectively link laboratory tests with construction practices and comprehend the underlying theoretical principles
2. To conduct tests on hardened concrete

3. To design and test concrete mix for the given workability and strength.
4. To conduct tests on fresh concrete
5. To equip the students with capability to conduct of experiments, analyze and interpret the results, draw suitable inferences in conformity with IS specifications.

**List of Experiments:**

**Tests on Cement**

1. Normal Consistency and setting times (Initial and Final)
2. Specific Gravity of Cement
3. Fineness of cement by Blaine's air permeability test and sieve test
4. Compressive strength of Cement

**Tests on Coarse Aggregates**

5. Specific gravity, water absorption and bulk density
6. Sieve analysis of Coarse aggregates for fineness modulus and gradation

**Tests on Fine aggregates**

7. Specific gravity, water absorption, bulk density and bulking of sand
8. Sieve analysis of Fine aggregates for fineness modulus and gradation

**Tests on fresh concrete**

Workability tests: Slump cone, Compaction factor, Vee–Bee Consistometer and
9 Flow table tests.

**Tests on Hardened concrete**

1. Concrete mix design using IS Code
2. Compression test on Concrete Cube
3. Split tensile strength test on Concrete Cylinder
4. Flexural Strength test on Concrete Beam

**Demonstration Experiments**

On site NDT (using rebound hammer) with short report Site visit to studyadvances in Concrete technology (like RMC, pumped 15 concrete)

**References:**


1. Gambhir M. L., **"Concrete manual"** , Dhapat Rai and Co
2. Shetty M. S., **"Concrete Technology"** , S. Chand and Co. Ltd., 2009
3. IS 383:1970, **"Specification for coarse aggregates and fine aggregates from natural sources for concrete"**
4. IS 650: 1991, **"Specification for standard sand for testing of cement"**


**IS Codes**


1. IS 2386 (Part 3) 1963, **"Methods of test for aggregates for concrete- speci fic gravity, density, voids, absorption and bulking"**
2. IS 4031 (Part I) 1996, **"Determination of fineness by dry sieving of cement "**
3. IS 10262: 2009, **"Concrete Mix design procedure"**


**Course Outcomes (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | **Conduct** the experiments on cement, coarse aggregates, fine aggregates, fresh cement concrete and hardened cement concrete | **L3** |
| 2 | C**ompare** the results obtained with relevant IS codes and write the **Conclusion** | **L4** |
| 3 | **Examine** the on-site strength of concrete using NDT | **L4** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall be able to design and conduct experiments and interpret the Results as per the current experiment. | **PO 04** |

2. Graduates shall imbibe the professional and ethical responsibilities of their Profession. **PO 08**
3. Graduates shall be capable of working productively in team with meaningful Contribution as a member and with leadership attributes. **PO 09**
4. Graduates shall possess effective oral and written communication skills **PO 10**

**Content Delivery/Assessments methods and Scheme of Evaluation:**

1. Continuous evaluation of conduct of Practical and Journals
2. Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

**1.Minimum marks required for eligibility for SEE: 13 out of 25**

**2.Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## BASIC SURVEYING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code:** | 16CVL38 | **Credits:** | 01 |
| **Course Type:** | PC | **CIE Marks:** | 25 |
| **Hours/week: L – T – P** | 0 – 0 – 2 | **SEE Marks:** | 25 |
| **Total Hours:** | 26 | **SEE Duration:** | 3 Hours for 50 marks |

**Course Learning Objectives (CLOs)**

1. Demonstrate the Linear and Angular surveying instruments used in field work
2. To determine the Reduced Level by rise and fall method and Height of instrument.
3. To Measure distance between Inaccessible points using plane table
4. Demonstrate the Minor Linear, Angular instrument and Area Measurement instrument

**List of Experiments:**

**Exp. No. Experiments**

**Chain Surveying**

1. To measure distance between two points using direct ranging.
2. To set out perpendiculars at various points on given line using cross staff, optical square, Chain and tape

**Compass surveying**

3. To determine the distance between two inaccessible points using chain/tape & compass
4. Measurement of bearing of the sides of a closed traverse & adjustment of closing error by Bowditch method and Transit method

**Leveling**

5. To determine difference in elevation between two points using differential leveling and Booking of levels using both HI and Rise & Fall methods
6. To determine difference in elevation between two points using Fly leveling, conduct fly back leveling and Booking of levels using HI methods
7. To conduct profile leveling for water supply /sewage line and to draw the longitudinal section and to determine the depth of cut and depth of filling for a given formation level
8. To conduct Block Leveling for an area and plot contours

**Study of Map**

9. Study of Topographic sheets: Survey of India topographical Maps and their numbering, Scale, Map components and Calculation of area and volume of contours.

**Demonstration of Minor Instruments**

10 Minor instruments – Clinometers, Ceylon ghat tra cer, Hand level, Box sextant, Planimeter and Pantagraph

11 Demonstration of plane table surveying with accessories

**Mini Project**

12 To conduct profile leveling and cross section leveling for road project, draw the longitudinal and cross sections and determine the depth of cutting and filling for a given formation level.

**References:**


1. Punmia B. C., **"Surveying Vol–1",** Laxmi Publications, New Delhi, 16th edition, 2005
2. Subramanian R., **"Surveying and Leveling",** Oxford University Press, Third edition, 2007
3. Venkataramiah C., " **Text Book of Surveying",** Universities Press, Second edition, 2011
4. Rethaliya R. P.**, "Surveying",** Atul Prakashan, Gandhi road, Ahmadabad.
5. Kanetkar T. P and Kulkarni S.V., **"Surveying and Levelling Part- I",** Vidyarthi Ghrih Prakashan Pune, 24th edition 2010.


**Course Outcomes (COs)**

**At the end of the course, students will be able to:**

1. **Get acquainted** with the behavior of the structural steel.[L3]
2. **Get acquainted** with the behavior of the wooden member subjected to bending and compression[L2]
3. **Characterize** the important building materials by conducting appropriate tests in conformity with the specified IS code procedures.[L3]
4. **Ascertain** the suitability and applicability of construction materials.[L5]

**Program Outcome (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering.[PO1]
2. Graduates shall be able to design and conduct experiments and interpret the results as per the current research[PO4]
3. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures[PO5]

**Content Delivery/Assessments methods and Scheme of Evaluation**

1. Continuous evaluation of conduct of Practical and Journals
2. Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

**1.Minimum marks required for eligibility for SEE: 13 out of 25**
**2.Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## ELECTRONICS AND COMPUTER WORKSHOP LAB

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL39 | **Credits** | 02 |
| **Course type** | ES | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 0 – 0 – 3 | **SEE Marks** | 25 |
| **Total Hours:** | 36 | **SEE Duration** | 3 Hours for 50 Marks |

**Course Learning Objectives (CLOs)**

1. To understand various electronics components and its applications.
2. To understand electronics circuit design
3. To understand various computer hardware and their operation.
4. To understand disassembling and assembling of computer system.
5. To study various networking components.

**List of Experiments:**

**Exp. No. Experiments**

**Part A: Electronics Experiments**

**I. Study of basic passive and active electronics components**

1 Introduction to various electrical passive components such as R, C, L, transformers, relays, switches, bread board, universal printed circuit board and electronic devices

| | |
|---|---|
| | such as rectifying diode, Zener diode, light emitting diode, transistor, seven segment displays, LCD panel, Integrated circuit chip (with different packages and functionalities, both digital and analog) and Surface mount devices/chips. Acquaintance with ratings, specifications, packages of components and devices listed above, using data-sheets. |
| | **II. Introduction to various DC regulated power supplies, Cathode Ray Oscilloscope (CRO), Function Generators, and different Electronic Measuring Meters** |
| 2 | Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, IC tester and Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, AC mains voltage/ 1 KHz Square wave/any small signal from function generator on Oscilloscope, Testing of sample digital ICs using IC tester. |
| | **III. Construction and testing of basic electronics circuits** |
| 3 | Circuit building practice on standard bread board using simple ICs, components and single strand wires, performing cold test and functionality verification wherever possible. |
| 4 | Building and testing regulated DC power supply, (Fullwave rectifier ), voltage divider circuits using resistors, relay driver using transistors and building burglar alarm circuit |
| | **IV. Simple PCB design and testing** |
| 5 | The single sided printed circuit board (PCB) shall be designed manually. |
| 6 | The designed circuit layout should be transferred to copper clad laminate board and etched using Hydrochloric Acid |
| 7 | After soldering the components and devices onto the PCB, the design should be tested and demonstrated for intended functionality |
| 8 | Sample Examples of Circuits for BUILD and TEST projects:<br>1. IC 555 based timer and square wave generator<br>2. OP-amp IC 741 based analog computer(adder/subtractor/integrator/Differentiator)<br>3. FM remote lock for vehicle<br>4. Digital Clock<br>5. Temperature sensor and display |
| | **Part B: Computer Workshop** |
| | **I. Introduction to basic computer hardware** |
| 9 | Name and identify various PC hardware components: USB Mouse, PS/2 Mouse, Keyboard, LCD/LED Monitor, VGA, HDMI, CAT5, CAT6, server, routers, fiber cable, Hard disk, RAM, CMOS battery, SMPS, cache, ROM, BIOS |
| 10 | To assemble and disassemble computer hardware |
| 11 | To install different operating systems with dual boot:<br>Install any two operating systems on a PC making it dual boot, including latest version of Ubuntu Linux, Windows 7/8 |
| | **II Introduction to computer networks and it's components** |
| 12 | Network Hub (4/8 ports), CAT6 cables network tool kit (Network crimper, Cable Tester, Wire stripper) |
| 13 | Connect 2-4 computers together using a network hub to create a LAN |

**Text Books**

1. Allen Mottershed, **"Electronic devices and circuits"** , Prentice Hall Inc
2. Robert L Boylestead. **" Electronic devices and Circuit theory"** , PEARSON
3. Ron Glister. **"PC Hardware: A Beginner's Guide"** , Osborne/ McGraw -Hill
4. BehrouzA.Forouzan. **"Data Communication and Networking"** , McGraw –Hill

**References**

1. Satish Jain , **"Electronics Components And PC Hardware"** , BPB Publication
2. Ramakant A. Gayakwad, **"Op-amp and Linear Integrated circuits"** , Prentice Hall Inc
3. Nurul Sarkar, **"Tools for Teaching Computer Networking And Hardwar e Concepts"** , Infosci Publication

**Course Outcomes (COs)**

| **At the end of the course, the student will be able to:** | **Bloom's Level** |
|---|---|
| 1. **Distinguish** various electronics components**.** | **L4** |
| 2. **Analyze** and **design** electronics application circuits. | **L4 L6** |
| 3. **Identify** various parts computer hardware. | **L3** |
| 4. **Testing** of a computer model. | **L4** |
| 5. **Analyze** computer networking. | **L4** |

**Program Outcome (POs)**

| | |
|---|---|
| 1. **Fundamentals of Engineering:** Graduates shall be able to understand and apply the basic mathematical and scientific concepts in the field of Electronics and Communication Engineering. | **PO 1** |
| 2. **Design of Experiments:** Graduates shall possess the ability to design and conduct experiments, analyze and interpret data. | **PO 2** |
| 3. **Engineering Cognizance:** Graduates shall be able to stay abreast with recent developments in the field of Electronics and Communication Engineering | **PO5** |

**Assessment methods**

1. Internal Test
2. Quiz
3. Activity
4. Viva-Voce
5. Mini Project/ Course Activity

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Conduct of the lab | Journal submission | Total Marks |
|---|---|---|---|
| Maximum Marks: 25 | 10 | 15 | 25 |

- **Minimum marks required for eligibility for SEE: 13 out of 25**
- **Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.

3. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

**SEMESTER IV**
**PARTIAL DIFFERENTIAL EQUATIONS AND SAMPLING TECHNIQUES**
**(Civil/Mechanical)**

| | | | |
|---|---|---|---|
| **Course Code** | 16MATMC41 | **Credits** | 04 |
| **Course type** | BS | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

**Course learning objectives (CLOs)**

1. Learn the concept of Interpolation and use appropriately.
2. Understand the concept of Partial Differential Equations.
3. Apply Partial Differential Equations to solve practical problems.
4. Get acquainted with Sampling Distribution and Testing of Hypothesis.
5. Study the concept of Calculus of Variations and its applications.

**Pre-requisites :**

1. Partial Differentiation
2. Basic Probability, Probability Distribution
3. Basic Integration
4. Basic Statistics

**UNIT I**

**Finite Differences and Interpolation:**, Forward and Backward differences, Newton's Forward and Backward Interpolation Formulae, Divided Difference, Newton's Divided Difference Formula (without proof). Lagrange's Interpolation Formula. Illustrative examples. Numerical Integration: Newton- Cotes Quadrature formula, Trapezoidal rule, Simpsons $1/3^{rd}$ rule, Simpsons $3/8^{th}$ rule, Weddle's rule. Practical Examples

**08 Hours**

**UNIT II**

**Partial Differential Equations:** Formation of PDE by elimination of arbitrary Constants and Functions, Solution of non homogeneous PDE by direct integration, Solution of homogeneous PDE involving derivative with respect to one independent variable only.

**08 Hours**

**UNIT III**

**Applications of Partial Differential Equations:** Derivation of One dimensional Heat and Wave equations. Solutions of one dimensional Heat and Wave equations, Two dimensional Laplace equation by the method of separation of variables. Numerical solution of one dimensional Heat and Wave equations, Two dimensional Laplace equation by finite differences.

**08 Hours**

**UNIT IV**

**Sampling distribution and Testing of Hypothesis:** Sampling, Sampling distribution, Sampling distribution of means, Level of significance and confidence limits, Tests of significance for small and large samples. 't' and 'chi square' distributions. Practical examples.

**08 Hours**

## UNIT V

**Calculus of Variations:** Concept of a Functional, Extremal of a Functional, Euler's equation and equivalents. Standard problems. **Applications**: Geodesics, Hanging chain, Minimal surface of revolution and Brachiostochrone problem.

**08 Hours**

**Text Books**


1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. P.N.Wartikar & J.N.Wartikar– Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994.
3. B.V. Ramana- Higher Engineering Mathematics,Tata McGraw-Hill Publishing Company Ltd.


**Reference Books:**


1 Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006

2 Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.

3 Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.


**Course Outcome (COs)**

| | **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|---|
| 1. | **Use** Finite differences in Interpolation | **L3** |
| 2. | **Form** and **Solve** Partial differential Equations. | **L2, L3** |
| 3. | **Develop** Heat, Wave equations | **L3** |
| 4. | **Apply** Partial Differential Equations to solve practical problems | **L3** |
| 5 | **Test** the Hypothesis and **Solve** problems related to them**.** | **L2** |
| 6 | Understand the concept of Functional and **Identify** the extremal of a Functional**.** | **L3** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| **1** | An ability to apply knowledge of Mathematics, science and Engineering. | **PO 1** |
| **2** | An ability to identify, formulate and solve engineering problems | **PO 5** |
| **3** | An ability to use the techniques, skills and modern engineering tools necessary for engineering practice | **PO 11** |

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Black Board Teaching | 1. Internal Assessment |
| 2. Scilab | 2. Assignment |
| | 3. Quiz |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE: 20 out of 50**

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

| | |
|---|---|
| 1. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions |
| 2. | SEE question paper will have Two compulsory questions and choice will be given to remaining three units. |
| 3. | SEE will be conducted for 100 marks of three hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |

## VECTOR CALCULUS, LAPLACE TRANSFORMS AND PROBABILITY
### (MECHANICAL, CIVIL, ELECTRONICS & COMMUNICATION, ELECTRICAL & ELECTRONICS)
### (FOR LATERAL ENTRY ONLY)

| | | | |
|---|---|---|---|
| **Course Code** | 16DIPMATM41 | **Credits** | 05 |
| **Course type** | BS | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 4–1– 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 50 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Study the concept of Double and Triple integrals, Vector Differentiation
2. Get acquainted with vector integration and its applications.
3. Be proficient in Laplace Transforms and Inverse Laplace Transforms and solve problems related to them.
4. Learn the concept of Interpolation and use appropriately.
5. Study the concept of Random variables and its applications.

**Pre-requisites:**

1. Basic Probability, Probability Distribution
2. Basic Statistics
3. Basic Differentiation and Integration

**UNIT I**

**Vector and Integral Calculus**

Double and triple integrals.Scalar and Vector point function, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields.

**10Hours**

**UNIT II**

**Vector Integration**

Line Integral, Surface Integral and Volume Integral, Green's Theorem, Stoke's Theorem, Guass Divergence Theorem (statement only) and problems

**10 Hours**

## UNIT III

**Laplace Transforms**

Definition, Laplace Transforms of elementary functions. Laplace Transforms of $e^{at}f(t)$, $t^n f(t)$, $\int_0^t f(t)dt$ , $\frac{f(t)}{t}$ (without proof), Inverse Laplace Transforms: Inverse Laplace Transforms - Problems, Applications to solve Linear Differential Equation.

**10 Hours**

## UNIT IV

**Finite Differences and Interpolation**: Forward and Backward differences, Newton's Forward and Backward Interpolation Formulae, Divided Difference, Newton's Divided Difference Formula (without proof). Lagrange's Interpolation Formula. Illustrative examples. Numerical Integration: Trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Weddle's rule. Practical Examples

**10 Hours**

## UNIT V

**Probability**: Random Variables (RV), Discrete and Continuous Random variables, (DRV, CRV) Probability Distribution Functions (PDF) and Cumulative Distribution Functions(CDF), Expectations, Mean, Variance. Binomial, Poisson, Exponential and Normal Distributions (Only examples)

**10 Hours**

**Text Books:**


1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2. P. N. Wartikar & J. N. Wartikar – Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994 and onwards.
3. B. V. Ramana - Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.


**Reference Books:**


1. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
2. Peter V. O' Neil –Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011 and onwards.
3. Glyn James Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010 and onwards.


### Course Outcome (COs)

**At the end of the course, the student will be able to**

1. **Evaluate** Double and Triple Integration. [L3]
2. **Explain** the concept of vector Differentiation and Integration.[L2]
3. **Define** Laplace Transforms, Inverse Laplace Transforms and **Solve** problems related to them[L3].
4. **Use** Finite differences in Interpolation**.[L3]**
5. **Understand** the concept of Random variables, PDF, CDF and its applications[L2]
6. **Use** of Probability distribution for practical problems[L3]

### Program Outcome (POs)

1. An ability to apply knowledge of Mathematics, science and Engineering.[PO1]
2. An ability to identify, formulate and solve engineering problems.[PO5]
3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.[PO11]

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Black board teaching | 1. Internal Assessment Tests |
| 2. Power point Presentation | 2. Assignments |
| 3. Scilab/ Matlab/ R-Software | 3. Quizzes |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE: 20 out of 50**

**Scheme of Semester End Examination (SEE):**

1. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions.
2. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.
3. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.

## ADVANCED SURVEYING

| | | | |
|---|---|---|---|
| **Course Code** | 16CV42 | **Credits** | 03 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1. Illustrate the objective and working of Theodolite and EDM Devices.
2. Explain the fundamentals of Trigonometric and tachometry surveying.
3. Identify the different steps and computation involved in advance surveying
4. Design of simple, compound, reverse, vertical and transition curves.
5. Understand the applications of GIS and GPS in the civil engineering works.

**Pre-requisites:**

1. Basic Surveying

### UNIT I

**Theodolite and Trigonometric Surveying**

**Theodolite**: Parts of a theodolite, Fundamental lines and their desired relations, Temporary adjustments, Measurement of horizontal and vertical angles, Repetition and Reiteration method.

**Trigonometric Surveying:** Heights And Distances: Determination of height of (i) An accessible object and (ii) Inaccessible object- single plane and double plane methods, Determination of distance and difference in elevation between two inaccessible points.

**Self Learning Topics:** Permanent adjustments of theodolite.

**10 Hours**

**UNIT II**

**Total Station**

Introduction to Total station, Temporary adjustments. File Manager: Job Creating, Selecting Storing, View and editing, deletion, transferring collected data. Measurement functions-Missing Line Measurement (MLM), Remote Distance Measurement (RDM), Area measurement and volume measurement, Remote elevation Measurement (REM), Setting out (Staking out) & Special functions. Uses of Total Station, Advantages of using total station over the conventional surveying instruments.

**08 Hours**

**UNIT III**

**Curves**

Simple Curves-Definition, Designation-Elements of curves, Setting out of simple curves -

Linear methods-perpendicular offsets from long chord and chords produced method.

Instrumental methods-Rankine's Method and Numerical problems, Compound Curves-

Definition, Elements, Various cases (No derivations), Numerical problems

**08 Hours**

**UNIT IV**

**Reverse, Transition and Vertical Curves**

Reverse curves- Definition, Elements, parallel tangents method (No derivation), Transition curves and Characteristics. Length of Transition curve, types of transition curves. Vertical curves – Types – Simple numerical problems.

**06 Hours**

**UNIT V**

**GIS and GPS**

Introduction to GIS- Definition, Key Components, Functions, Data types, layer concepts, analysis of data and cartography. Applications of GIS in Civil Engineering. Introduction to aerial photogrammetry, Triangulation survey. Global Positioning system-GPS satellite systems, components of GPS, positioning and relative positioning with GPS, Applications of GPS in civil engineering. Introduction to DGPS and its uses

**08 Hours**

**Text books:**


1. B. C. Punmia,"Surveying Vol 2 and Vol 3"-, Laxmi Publications, Twelfth edition reprint, 2005
2. A. M. Chandra,"Plane Surveying",New age international ( P) Ltd., Third edition, 2015
3. A.M. Chandra,"Higher Surveying", New age international(P) Ltd., Revised second edition,2007
4. SatheeshGopi, R. Sathikumar and N. Madhu- "Advance Surveying"- Pearson Education, India., Second edition, 2008.


**Reference books**:


1. Milton O. Schimidt and Wong, "Fundamentals of Surveying", CL-Engineering, ISBN 13: 9780534041618, 1985.
2. S.K. Roy,"Fundamentals of Surveying".,PHI Learning Pvt. Ltd., ISBN 8120341988, 9788120341982, 11-Oct-2010.

3. Arther Bannister et al.,"Surveying", Pearson Education, India., Seventh edition, 1998.

**Course Outcomes (COs)**

**At the end of the course, students will be able to:**

1. **Understand** the application of theodolite in civil engineering works. [L2]
2. **Identify** the problem solving skills and procedures for Trigonometric surveying. [L2\3]
3. **Construct** the different curves required for civil engineering works.[L3]
4. **Identify** problem solving skills and mistakes occurring in field measurements by advance surveying instruments.[L3]
5. **Demonstrate** applications of advance surveying methods[L2]

**Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. [PO1]
2. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures[PO5]

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.

2. Minimum marks required in SEE to pass: 40 out of 100

3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY

| | | | |
|---|---|---|---|
| **Course Code** | 16CV43 | **Credits** | 03 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course Learning Objectives (CLOs)**

1. Acquire knowledge about different types of foundations and their design and preliminary investigations of soil and different types of bonds in masonry.
2. Acquire knowledge about Flooring, Roofing materials**.**
3. Acquire knowledge about various types of doors, windows and lintels.
4. Design various types of stairs and acquire knowledge about lifts and ventilators.
5. Acquire knowledge about painting, plastering and damp proof materials.

**Pre-requisites:**

**----Nil------**

### UNIT I

**Foundation and Masonry**

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

**Masonry**: Introduction, Classification of Masonry, Definition of terms used in Masonry, Introduction to classification and qualities of bricks, Bonds in Brick work - English Bond, Flemish Bond Common building stones, their properties and uses, Classification of stone masonry, Joints in stone masonry.

**10 Hours**

### UNIT II

**Roofs and Floors**

Types of Roofs & Roofing materials, Flat roof (RCC), Types of pitched roofs, Wooden Truss, Steel trusses, Types of flooring, Factors affecting selection of flooring materials

**Self Learning Topics:** Load bearing walls, cavity walls & partition walls

**06Hours**

### UNIT III

**Doors, windows and ventilation**

Location of doors and windows, Definition of technical terms, Types of Doors, Types of windows, Varieties of materials for doors and windows & their properties. Definition and classification of Lintels. Definition and Purposes of Ventilation

**08 Hours**

## UNIT IV

**Stairs, Lifts and Escalators**

Definition of technical terms in stairs, Requirements of stair, Types of Stairs, Geometrical design of RCC Dog legged and open well stairs (Plain and sector elevation). Definition and essential requirements of Lifts and Escalators.

**08 Hours**

## UNIT V

**Miscellaneous Topics**

Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering, Introduction to Paintings and types of Painting, Damp Proofing - Causes of Dampness, Effects of Dampness, Methods of Damp Proofing.

**Self Learning Topics:** Introduction to formwork and scaffolding

**08 Hours**

**Text books:**


1. Rangawala S.C., **"Engineering Materials",** Charter Publishing House, Anand, India, 35th Edition 2008
2. Sushil Kumar, **"Engineering Materials",** Standard Publication and Distributors, New Delhi.
3. B.C Punmia., "**Building Construction",** Laxmi Publications Ltd New Dehli. Dec 2006


**Reference books:**


1. P.G. Varghese, "**A Text Book on Building Materials"**, Prentice-Hall of India Pvt. Ltd., Publication.
2. Mohan Rai and M.P. Jain Singh, "**Advances in Building Materials and Construction"** publication by CBRI, Roorkee.
3. Neville A.M and Brooks J.J, "**Concrete Technology",** ELBS Edition. London
4. Gambhir M.L –DhanpatRai and Sons, "**Concrete Technology",** New Delhi.


**Course Outcomes (COs):**

**At the end of the course, students will be able to:**

1. **Understand** fundamentals of construction, such as foundation, masonry, floors, and roofs.
2. **Classify** the different types of foundation and their suitability.
3. **Design** various types of foundations and stairs.
4. Able to **understand** different types doors, windows
5. Able to **illustrate** the **importance** of beams, columns and damp proof materials

**Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering [L2]
2. Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues [L2]
3. Graduates shall be able to understand contemporary societal issues to address them professionally [L6]
4. Graduates shall be able to understand the impact of engineering solutions to environmental sustainability [L5]
5. Graduates shall imbibe the professional and ethical responsibilities of their profession [L6]

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |

3. Power Point Presentation
4. Videos

3. Internal Assessment Tests
4. Semester End Examination

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## ANALYSIS OF DETERMINATE STRUCTURES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV44 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course Learning Objectives (CLOs)**

1. To differentiate between determinate and indeterminate structure. Learn to determine static and kinematic indeterminacy of trusses, beams and frames and to analyze determinate trusses by i) method of joints, and ii) method of sections.
2. Learn to determine the rotations and deflections of determinate beams by i) Moment-Area method, and ii) Conjugate-beam method.
3. Understand what strain energy is and derive expressions for strain energy in members due axial load, bending and shear. Understand the principle of virtual work, Castigliano's first theorem and apply it to beams and frames to determine the deflections in them. Also understand Clarke-Maxwell's theorem of reciprocal deflection.
4. Learn to analyze three hinged parabolic arches with supports at same and different levels and determine the thrust, bending moment and shear in the arches and also to analyze cables under point load and UDL and to determine the length of the cable for supports at same levels.

5. Develop influence line diagram for reaction , shear force and bending moment for simply supported beam subjected to single point load and UDL.

**Pre-requisites:**

1. Elements of Civil Engineering,
2. Strength of Materials.

**UNIT I**

**Structural systems and analysis of trusses**

Determinate and indeterminate structures (static and kinematic (degrees of freedom)), conditions of equilibrium, introduction to truss, assumptions in analysis of perfect truss, analysis of perfect truss by method of joints and sections

**08 Hours**

**UNIT II**

**Deflection of Beams**

Deflection and slope of beams by i) Moment-Area method; ii) Conjugate beam method

**08 Hours**

**UNIT III**

**Deflection of Beams by Strain Energy**

Strain energy, Strain energy due to axial load, bending and shear, principle of virtual work, first theorem of Castigliano, problems on beam and frames, Clarke-Maxwell's theorem of reciprocal deflection.

**Self learning topics:** Clarke-Maxwell's theorem of reciprocal deflection.

**08 Hours**

**UNIT IV**

**Arches and Cables**

Three hinged parabolic arches with supports at same and different levels, determination of thrust, shear and bending moment, analysis of cables under point loads and UDL, length of cables (supports at same levels).

**Self learning topics:** Analysis of cables with supports at different levels.

**08 Hours**

**UNIT V**

**Rolling Loads and Influence Lines**

Introduction to rolling loads on simply supported beams. Influence line diagram for reaction, shear force and bending moment of simply supported beam subjected to a single point load and UDL shorter than span.

**08 Hours**

**Text Books:**

1. Pandit and Gupta**, "Theory of structures",** Tata McGraw Hill, New Delhi, 2004.
2. Reddy C S**, "Basic Structural Analysis",** Tata McGraw Hill, New Delhi, 2007.

**Reference books:**

1. Hibbeler R. C, **"Structural Analysis"**, Pearson, Sixth Edition, 2007.
2. Norris and Wilbur, **"Elementary Structural Analysis",** McGraw Hill Book Co: New York, 2003.

**Course Outcomes (COs):**

**At the end of the course, students will be able to:**

1. **Identify** the static and kinematic indeterminacy of the structures and analyze the determinate trusses [L1]
2. **Evaluate** deflections and rotations of determinate beams. [L4]

3. **Apply** Castigliano's first theorem to beams and frames to determine the deflections in them.[L5]
4. **Analyze** three hinged parabolic arches and cables for different loading conditions.[L3]

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## HYDRAULICS AND HYDRAULIC MACHINES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV45 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. Describe the geometric elements of open channel flow and apply the concepts to solve related problems for uniform flow
2. Analyse problems related to most economical channel section including practical applications.
3. Illustrate the basic concepts of specific energy and critical flow.
4. Demonstrate the principles of specific force in hydraulic jump problems and its applications for practical problems.
5. Apply the concept of impulse momentum principle in case of impact of jets on plates and vanes.
6. Outline the concept of velocity triangles in case of impact of jet on curved vanes striking tangentially.
7. Outline the component parts of Pelton Wheel and Kaplan turbine and evaluate the efficiency.
8. Describe the working principle of centrifugal pumps and evaluate the performance.

**Pre-requisites:**

1. Engineering Mechanics
2. Fluid Mechanics

### UNIT I

**Uniform flow in open channels**

Introduction, Types of flow in channels, Geometric properties of Rectangular, Triangular, Trapezoidal and Circular channels. Chezy's equation, Manning's equation-problems

**Most economical channel sections**

Most economical open channels-Rectangular, Triangular, Trapezoidal and Circular channels-problems

**08 Hours**

### UNIT II

**Specific energy and Critical flow**

Introduction, Specific energy, Specific energy diagram, Critical depth, Conditions for Critical flow in rectangular, trapezoidal and triangular channels- Theory & problems.

**Hydraulic jump**

Hydraulic jump in a Rectangular, trapezoidal and triangular channels- Theory and problems. Practical applications of hydraulic jump. Types of hydraulic jump

**Self Learning Topics**: Critical flow in trapezoidal channels

**08 Hours**

### UNIT III

**Impact of jet on flat vanes**

Introduction, Impulse - Momentum equation. Force exerted by fluid jet on stationary flat plate and moving flat plate. Force exerted by jet on series of moving flat plates mounted on a wheel. Impact of a jet on a hinged flat plate - problems

**Impact of jet on curved vanes**

Introduction, Force exerted by a jet on a fixed curved vane and moving curved vane. Introduction to concept of velocity triangles, Impact of jet on a series of curved vanes-problems.

**08 Hours**

**UNIT IV**

**Pelton wheel**

Introduction to Turbines, Classification of Turbines. Head and efficiencies of hydraulic turbines, Peltonwheel- components, working and velocity triangles. Maximum power, efficiency, working proportions- problems.

**Kaplan Turbine**

Introduction, Components, Working proportions and Velocity triangles, Problems on Kaplan turbine. Draft Tube: Types, efficiency of a Draft tube. Introduction to Cavitation in Turbines. Specific speed.

**08 Hours**

**UNIT V**

**Centrifugal pumps**

Introduction, Component parts, working of a centrifugal pump, Work done by impeller, Head and Efficiencies. Minimum starting speed, velocity triangles and related problems. Multistage Centrifugal Pumps (Pumps in Series and Pumps in parallel). Specific speed - problems.

**08 Hours**

**Text Books:**


1. Dr. P. N. Modi & Dr S.M. Seth, "**Hydraulics and Fluid Mechanics**", Standard Book House- New Delhi.2009 Edition.
2. R. K. Rajput ,"**A TextBook of Fluid Mechanics & Hydraulic Machines**"-,S.Chand& Co, New Delhi, 2006 Edition.
3. R. K. Bansal. "**Text Book of Fluid Mechanics & Hydraulic Machines**", Laxmi Publications, New Delhi, 2008 Edition
4. N. Narayana Pillai ,"**Principles of Fluid Mechanics and Fluid Machines**", Universities Press (India), Hyderabad,2009 Edition.


**Reference Books:**


1. Bruce R. Munson, Donald F.Young, Theodore H. Okiishi ,"**Fundamentals of Fluid Mechanics**" , Wiley India, New Delhi, 2009 Edition.
2. Edward J. Shaughnessy. Jr; Ira M. Katz:; James P Schaffer , "**Introduction To Fluid Mechanics**" , Oxford University Press, New Delhi, 2005 Edition.
3. Madan Mohan Das, "**Fluid Mechanics and Turbomachines**"-, PHI Learning Pvt. Limited, New Delhi.2009 Edition.


**Course Outcome (COs)**

**At the end of the course, students will be able to:**

1. **Apply** basic principles to analyze and Solve open channel flow problems[L3]
2. **Apply** principles of energy concepts to practical applications of free surface flow[L3]
3. **Explain** the concept of Impact of jet on vanes[L2]
4. **Identify** the type of turbine based on head, quantity of flow and speed[L3]
5. **Apply** the principles of hydraulics and **Evaluate** the efficiencies of turbines and centrifugal pump[L5]

**Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts [PO1]
2. Graduates shall be able to design and conduct experiments and interpret the results as per the current research[PO4]

3. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures[PO5]
4. Graduates shall possess effective oral and written communication skills[PO10]

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

**ADVANCED SURVEYING LAB**

| | | | |
|---|---|---|---|
| **Subject Code** | 16CVL46 | **Credits** | 01 |
| **Course Type** | PC | **CIE Marks** | 25 |
| **Hours/week: L – T – P** | 0-0-2 | **SEE Marks** | 25 |
| **Total Hours** | 26 | **SEE Duration** | 3 Hours for 50 Marks |

**Course Learning Objectives (CLOs)**

1. Make use of the Theodolite and Total station in field work.

2. To measure the Horizontal and Vertical angles by using theodolites.
3. Setting out of simple curves and compound curves.
4. Demonstrate the advanced instruments used in surveying.

**Lists of Experiments**

**1. Theodolite Surveying:**

- Parts of theodolite, Measurement of horizontal angles and vertical angles using theodolite
- Measurement of horizontal angles with method of repetition and reiteration using Theodolite
- To determine the elevation of an object using single plane method when base is accessible and inaccessible(At different level & At very different level)
- To determine the distance and difference in elevation between two inaccessible points using double plane method

**2. Curves using Linear and Angular instrument**

- To set out simple curves using Rankine's deflection angles method
- To set out compound curve with angular methods with theodolite only

**3 Setting out:**

- To set out the center line of a simple rectangular room using offset from base line

**4 Total Station:**

- Demonstrate Basic Functions and keys used in total station
- Preparation of Contour map, Calculation of area and volume, stake out (small building) etc
- Setting out of simple circular curve using Rankine's deflection angles method by Total Station

**Demonstration of Instruments and Software:**

- DGPS, E-Survey
- Software used for calculating & plotting different surveying works

**Reference Books**


1. Punmia B.C–**"Surveying Vol–1",** Laxmi Publications, New Delhi, Sixteenth edition, 2005 and above.
2. Subramanian R–**"Surveying and Levelling",** Oxford University Press, Third edition 2007 and above.
3. Venkataramiah C- "**Text Book of Surveying",** Universities Press, Second edition 2011 and above.
4. Dr.R.P.Rethaliya**-"Surveying",** Atul Prakashan, Gandhi road, Ahmadabad, ISBN No.: 978-93-81-518-35-9
5. Kanetkar T.P and Kulkarni S.V - **"Surveying and Levelling Part- I",** Vidyarthi Ghrih Prakashan Pune, Twenty fourth edition 2010 and above.


**Course Outcomes (COs)**

**At the end of the course, students will be able to:**

1. **Understand** the applications of surveying instruments in civil engineering project
2. **Identify** the various instruments used for field work
3. **Understand** the application of Theodolite and Total station in surveying projects
4. **Create** plans or maps to represent the area on a horizontal plane by using advanced surveying instruments
5. **Make use of** techniques, skills and advanced surveying instruments necessary for engineering practice

**Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering.
2. Graduates shall be able to design and conduct experiments and interpret the results as per the current research.
3. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.

**Content Delivery/Assessments methods and Scheme of Evaluation:**

1. Continuous evaluation of conduct of Practical and Journals
2. Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

1. **Minimum CIE marks required for eligibility for SEE: 13 out of 25**
2. **Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

a. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
b. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
c. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## HYDRAULICS AND HYDRAULIC MACHINERY LABORATORY

| | | | |
|---|---|---|---|
| **Course Code:** | 16CVL47 | **Credits:** | 01 |
| **Course Type:** | PC | **CIE Marks:** | 25 |
| **Hours/week: L – T – P** | 0– 0 –2 | **SEE Marks:** | 25 |
| **Total Hours:** | 30 | **SEE Duration:** | **3 Hours for 50 marks** |

**Course Learning Objectives (CLOs)**

1. Identify and calculate the various discharge coefficients for measurement of discharge And types of head losses in open channel flow.

2. Identify and calculate the various discharge coefficients for measurement of discharge and types of head losses in pipes by applying the concepts of mass and energy.
3. Apply the concept of impulse momentum principle and evaluate the impact coefficient for various types of vanes.
4. Demonstrate the applications of Bernoulli's equation
5. Identify and conduct experiments on pumps and turbines and evaluate its performance characteristics.

**Pre-requisites:** Fluid Mechanics and Hydraulics and Hydraulic machines

**List of Experiments:**

1. Calibration of Notches and weirs
2. Calibration of collecting tank ( gravimetric method )
3. Calibration of pressure gauge ( dead weight method )
4. Verification of Bernoulli's equation
5. Calibration of Venturiflume
6. Calibration of Venturimeter and Orificemeter
7. Determination of Darcy's friction factor for a straight pipe
8. Minor loses
9. Determination of Hydraulic coefficients of a vertical orifice and mouth piece
10. Determination of vane coefficients for vanes
11. Performance characteristics of a single stage centrifugal pump
12. Performance characteristics of a Pelton wheel
13. Performance characteristics of a Kaplan turbine
14. Performance characteristics of a Francis turbine
15. Demonstration of hydraulic jump

**Reference Books:**


1. P.N.Modi and S.M.Shet "Hydraulics and Fluid Mechanics "Standard Book house, New Delhi
2. Bansal R K., "Fluid Mechanics and Hydraulics Machines ", Lakshmi Publication, New Delhi.
3. Sarbjit Singh "Experiments in Fluid Mechanics " PHI Pvt. Ltd.- NewDelhi-
4. Dr. N. Balasubramanya "Hydraulics and Hydraulic Mechines Laboratory Manual"


**Course Outcomes (COs)**

| | **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|---|
| 1 | **Determine** various hydraulic coefficients and compare the results by graphs | **L5 L4** |
| 2 | **Make use of** Bernoulli's equation | **L3** |
| 3 | **Explain and evaluate** characteristics and performance of pumps and | **L5** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO 1** |
| 2 | Graduates shall be able to design and conduct experiments and interpret the results as per the current research. | **PO 4** |

| | | |
|---|---|---|
| 3 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures . | **PO 5** |
| 4 | Graduates shall be capable of working productively in team with meaningful contribution as a member and with leadership attributes. | **PO 9** |
| 5 | Graduates shall possess effective oral and written communication skills. | **PO 10** |

**Assessment methods**

1. Viva voce
2. Internal assessment
3. Weekly journal correction

**Scheme of Continuous Internal Evaluation (CIE):**

| Conduct of the lab | Journal submission | Lab test | Total Marks |
|---|---|---|---|
| 10 | 10 | 5 | 25 |

Submission and certification of lab journal is compulsory to qualify for SEE.
Minimum marks required to qualify for SEE : 13

**Scheme of Semester End Examination (SEE):**

1 Will be conducted for 50 marks of 3 hours duration and It will be reduced to 25 marks for the calculation of SGPA and CGPA.

2 Minimum marks required in SEE to pass: 20

| | |
|---|---|
| Initial write up | 20 marks |
| Conduct of experiments | 20 marks |
| Viva-voce | 10 marks |

## BUILDING PLANNING AND DRAWING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL48 | **Credits** | 03 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 1-0-4 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 4 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1 To understand principles of planning and building bye-laws.
2 To plan residential & public buildings according to bye-laws.
3 To plan building components like footings, stairs, doors and windows.
4 To understand the planning and design of water supply, sanitation and electrification.
5 To understand the commands used in AutoCAD to draw the above drawings.

**Pre-requisites:**

Building Materials and Construction Technology

**UNIT I**

**Introduction to planning**

Principles of planning, building byelaws, notations and symbols used in drawings, Types of buildings- Residential (load bearing and framed), public buildings

**03 Hours**

**UNIT II**

**Preparation of drawings**

To prepare drawings of Building components consisting of R.C.C column footing, wall footing and stairs (Dog legged and open well) – Plan and cross section. Doors and windows (Elevation and cross section)

**10 Hours**

**UNIT III**

**Residential Buildings**

Preparation of Plan, elevation, cross section and schedule of openings for load bearing and framed structures - ground floor, first floor and two storey buildings Framed only.

**12 Hours**

**UNIT IV**

**Public Buildings**

Preparation of Plan, elevation, cross section and schedule of openings for public buildings like primary schools, offices, primary health centre

**12 Hours**

**Self Learning Topic**

Preparing a model using mount board for a residential building/ Public buildings.[Unit 3 and 4]

**UNIT V**

**Building services:**

Preparing a line diagram showing building services like water supply, sanitation and electrification for prepared plans of residences and public buildings

**03Hours**

**Text books:**

**1** Shah M.H and Kale C.M., "Building Drawing", Tata McGraw Hill Publishing Co. Ltd.
**2** Sushil Kumar "Building Construction", Lakshmi Publications, New Delhi.

**Reference books**:

1. National Building Code, BIS
2. Building byelaws from local Authority.

**Course Outcomes (COs)**

| At the end of the course, students will be able to: | Bloom's Level |
|---|---|
| 1. Plan residential buildings following principles of planning. | **L3** |
| 2. Plan building components like footings, stairs, doors and windows. | **L3** |
| 3. Understand planning of public buildings. | **L2** |
| 4. Understand the planning and design of Water supply, sanitation and | |

electrification **L2**

5. Plan residential buildings following principles of planning. **L3**

**Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts **PO 1**
2. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures **PO 5**

| **Course delivery methods** | | **Assessment methods** | |
|---|---|---|---|
| 1. | Lecture and Board | 1. | Assignments |
| 2. | NPTEL/ Edusat | 2. | Quizzes |
| 3. | Power Point Presentation | 3. | Internal Assessment Tests |
| 4. | Videos | 4. | Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE): PROPOSED**

The Total marks of CIE shall be 50. Drawing submission for 30 marks, one test for 10 marks , and 10 marks for class participation

| Components | Submission (Continuous evaluation) | Performance in tests | Class participation | Total Marks |
|---|---|---|---|---|
| Maximum Marks 50 | 30 | 10 | 10 | 50 |

- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 03 questions, Question 01 compulsory (60marks), Question no 02 and Question no 03 will have choice each question for 20 marks.

## DESIGN THINKING AND INNOVATION

| | | | |
|---|---|---|---|
| **Course Code** | 16CV49A | **Credits** | 02 |
| **Course type** | HS | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 1-0-2 | **SEE Marks** | ---- |
| **Total Hours:** | 40 | **SEE Duration** | ----- |

**Course Description:** In this course, students will learn how to apply Design Thinking to create new product and service innovations. This course intends to excite students about the power of Design Thinking with its roots in empathetic design, and—through hands-on experiences—equip them with the skills needed to use it. Students will experience the intersection of diversity, ethics/social responsibility, critical thinking and communication as they identify problems to address, craft their design challenge, engage in field research, synthesize their findings, brainstorm solutions, present their concepts, while expanding their personal/professional networks.

**Course Learning Objectives**

1. To understand the various processes and systems to address human needs by creating tangible products.
2. To pursue learners with emphasis on learning-by-doing and following a comprehensive process of design, engineering and producing products and systems.
3. To train the eye and hand in creative thinking, sharpen observational skills through site visits and case studies.

**Pre-requisites: None**

**Course content:**

**UNIT I**

**1. Introduction to Product Design:** Introduction to the course, role of Product Design in the domain of industry, product innovation, Designer's philosophy and role in product design,

What is good design?

**2. Product Design Methodology :**User Centered Design methods, Systems Approach, Product Design and Development Methodology, Design Thinking, Creativity and Innovation.

Research and analysis: Question framing and conducting research, design strategy.

Concept building: Create a Concept, Conceptualize Designs, Sketching, prototyping.

Testing: Usability Testing, Refine and Enhance Design

Discussions shall be done with reference to some Design Case Studies.

**04Hours**

**UNIT II (Branch specific):**

**Product Design Project (Problem Solving / Re-Design):**

6. Introduction to engineering design
7. Problem identification and requirement specification
8. Engineering design process
9. System design: conceptulization, synthesize, analyze
10. Documentation and writing technical reports
11. Preliminary Report Submission
12. Final Report Submission and presentation

**02 hours**

The course will be organized as workshop sessions with some mini-lectures and considerable individual work. All students will be encouraged to develop their own projects of innovations using these methods.

**Text Books:**


1. James Garratt, Design and Technology
2. WuciusWong, Principles of Design
3. Eskild Tjalve, A Short Course in Industrial Design
4. Francis D. K. Ching, Architecture - Form, Space and Order
5. Virtual & Physical Prototyping, Taylor & Francis
6. Engineering Design: A Systematic Approach, Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H.3rd ed. 2007, XXI, 617 p., ISBN 978-1- 84628-319- 2


**E-Resourses:**

1. http://www.ulrich-eppinger.net/
2. http://www.npd-solutions.com
3. http://www.qfdi.org
4. http://www.cheshirehenbury.com/rapid/

**Course Outcome (COs)**

| At the end of the course, the student will be able to | Bloom's Level |
|---|---|
| 1. Develop sketches, virtual and physical appearance models to communicate proposed designs | L2, L3 |
| 2. Ability to apply the principles of design studied in abstract to a minor project | L3 |
| 3. Refine product design considering design principles and manufacturing requirements and constraints. | L4 |
| 4. Design products using user centred design process | L6 |
| 5. Make mock-up model and working prototype along with design documentation. | L6 |

**Program Outcome (POs)**

1. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.[PO2]
2. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.[PO3]
3. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.[PO10]

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lectures | 1. Report |
| 2. PPT, Videos | 2. Model making |
| 3. Practice session | 3. Presentation |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Report | Creative Project and presentation | Mid review and Participation | Total Marks |
|---|---|---|---|---|
| Maximum Marks: 50 | 20 | 20 | 10 | 50 |

**Eligibility for passing**: 20 marks

**Report**:
A report shall contain the various aspects of the course undergone and needs to discuss the issues discussed in the course as a whole. The project report will also include the concepts and principles used for the creative project and relate them clearly to the content of the course. Also, it should contain the relevant bibliography (at least 3-5 scholarly sources).

**Creative Project**
Students will apply their insights on concepts and ideas explored in the course for designing the product or solving the industry/societal problem. The product (prototype/model) should be displayed and presented.

**Mid review and Participation**
Each student will be evaluated according to their contribution to the project, level of preparedness and oral presentation.

## ENVIRONMENTAL STUDIES

| | | | |
|---|---|---|---|
| **Course Code:** | 16CV49B | **Credits:** | Mandatory Non-Credit |
| **Course Type:** | HS | **CIE Marks:** | 25 |
| **Hours/week: L – T – P** | 1 – 0– 0 | **SEE Marks:** | 25 |
| **Total Hours:** | 12 | **SEE Duration:** | 2 Hours for 50 marks |

**Course Learning Objectives (CLOs)**

1. To understand the scope of Environmental Engineering.
2. Identify the Environmental impact due to Human activities.
3. To understand the concept of Disaster Management.
4. Identify the renewable and non renewable sources of energy.

5. Identify the various Legal aspects in Environmental Protection.

**Pre-requisites: NIL**

**UNIT I**

Definition of Environment, Ecology and Eco-system, Structure and functions of ecosystem, balanced ecosystem, Introduction to Environmental Impact Assessment.

Natural Resources: Material Cycles - Oxygen, Carbon, Nitrogen and Hydrological cycle. Importance of water quality, Water borne diseases, Water induced diseases, Significance of Fluoride in drinking water.

**03 Hours**

**UNIT II**

Energy - Different types of energy, Conventional and Non - Conventional sources – Advantages and Limitations of Wind Mills, Hydro Electric, Fossil fuel, Nuclear, Solar, Biomass and Bio-gas, Geothermal energy.

**03 Hours**

**UNIT III**

Disasters - Natural Disasters: Meaning and nature of natural disasters, their types and effects (Floods, drought, cyclone, earthquakes, Tsunami). Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution and marine pollution.

**03 Hours**

**UNIT IV**

Disaster Management: International strategy for disaster reduction. Concept of disaster management and national disaster management framework

**01 Hour**

**UNIT V**

Environmental Protection: Role of Government, Legal aspects, Initiatives by Non - Governmental Organizations (NGO), Environmental Education, Women Education. E waste and solid waste management rules

**02 Hours**

**Text Books:**


1. Benny Joseph, "**Environmental Studies**", Tata McGraw - Hill Publishing Company Limited (2005).
2. Ranjit Daniels R.J. and Jagdish Kirshnaswamy, "**Environmental Studies**", Wiley India Private Ltd., New Delhi (2009).
3. Rajagopalan R. "**Environmental Studies – From Crisis to Cure**", Oxford University Press (2005).
4. Sanjay K. Sharma, "**Environment Engineering and Disaster Management**", USP (2011).
5. Harsh K. Gupta, "**Disaster Management**", Universities Press (India) Pvt. Ltd (2003).


**References Books:**


1. Raman Sivakumar, "**Principles of Environmental Science and Engineering**", Second Edition, Thomson Learning, Singapore (2005).

2. Meenakshi P., "**Elements of Environmental Science and Engineering**", Prentice Hall of India Private Limited, New Delhi (2006).
3. Prakash S.M., "**Environmental Studies**", Elite Publishers, Mangalore (2007).
4. Erach Bharucha, "**Text Book of Environmental Studies**", for UGC, Universities Press (2005).
5. Tyler Miller Jr. G., "**Environmental Science – Working with the Earth**", Tenth Edition, Thomson Brooks/Cole (2004).

**Course Outcomes (COs)**

| | **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | **Explain** the importance of the Environment | **L2** |
| 2 | **Evaluate** Environmental disasters caused by human activities | **L5** |
| 3 | **Outline** the water stress problems and energy crisis in present era. | **L2** |
| 4 | **Explain and classify** the Renewable and Non Renewable sources of energy. | **L2** |
| 5 | **Summarize** the various Legislations related to Environment. | **L2** |

**Program Outcomes (POs)**

1 Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering**.[PO1]**
2 Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth[PO8]
3 Graduates shall maintain an awareness of contemporary issues and arrive at the environmentally sustainable solutions[PO9]
4 Graduates shall be proficient in the core principles of Civil Engineering such as Environmental Engineering, Geotechnical Engineering, Structural Engineering and Water Resources Engineering, and shall be able to apply these principles in Engineering practice.[PO10]

**Content Delivery/Assessments methods and Scheme of Evaluation:**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE):**
Three I.A. Tests of one hour duration to be conducted for 25 marks each. Average of the best two tests will be taken for CIE. All the questions are objective type carrying one mark each.

**Scheme of Semester End Examination (SEE):**
Main Exam Question paper consists of Two Sections i.e. A and B.

1. Section A consists of 25 objective type questions each question carries 1 mark. 5 objective type questions will be asked from each of the unit. Students have to answer all the objective type questions from Section A.
2. Section B consists of 8 descriptive questions covering at least one question from each unit. Each question carries 5 marks. Students have to answer any five full questions

## SEMESTER V

### Partial Differential Equations Z –Transforms and Stochastic Processes

### (Mechanical, Civil, Electronics And Communication, Electrical And Electronics)

### FOR DIPLOMA ONLY

| | | | |
|---|---|---|---|
| **Course Code** | 16DIPMATM51 | **Credits** | 05 |
| **Course type** | BS | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 4–1– 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 50 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives**

1. Get acquainted with Joint Probability Distribution
2. Study the concept of Stochastic processes.
3. Understand the concept of Partial Differential Equations
4. Apply Partial Differential Equations to solve practical problems.
5. Study the concept of Z transforms and its applications

**Pre-requisites :**

1. Partial Differentiation
2. Basic Probability, Probability Distribution
3. Basic Integration

**Detailed Syllabus**

**UNIT I**

**Joint PDF**

Discrete Joint PDF, conditional Joint PDF, Expectations (Mean, Variance and Covariance)

**10 Hours**

**UNIT II**

**Stochastic Processes**

Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.

**10 Hours**

**UNIT III**

**Partial Differential Equations**

Partial Differential Equations-Formation of PDE by elimination of arbitrary Constants and Functions, Solution of non-homogeneous PDE by direct integration, solution of homogeneous PDE involving derivative with respect to one independent variable only.

**10 Hours**

**UNIT IV**

**Applications of Partial Differential Equations**

Derivation of One dimensional Heat and Wave equations. Solutions of one dimensional Heat and Wave equations, Two dimensional Laplace equation by the method of separation of variables. Numerical solution of one dimensional Heat and Wave equations, Two dimensional Laplace equation by finite differences.

**10 Hours**

**UNIT V**

**Z –Transforms**

Definition, Standard Z transforms, Linearity, Damping rule, Shifting properties, Initial and Final value Theorems-Examples. Inverse Z transforms and Solution of Difference Equations by Z transforms.

**10 Hours**

**Text Books:**

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2. P. N. Wartikar & J. N. Wartikar – Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994 and onwards.
3. B. V. Ramana - Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

**Reference Books:**

1. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
2. Peter V. O' Neil –Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011 and onwards.
3. Glyn James Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010 and onwards.

## Course Outcome (COs)

| At the end of the course, the student will be able to | Bloom's Level |
|---|---|
| 1. **Apply** Joint Probability Distribution to solve relevant problems | **L3** |
| 2. **Apply** Stochastic processes to solve relevant problems | **L3** |
| 3. **Form** and **Solve** Partial differential Equations. | **L2, L3** |
| 4. **Develop** Heat, Wave equations | **L3** |
| 5. **Apply** Partial Differential Equations to solve practical problems. | **L3** |
| 6. **Apply** Z-Transforms to solve Engineering problems. | **L3** |

## Program Outcome (POs)

| | |
|---|---|
| 1. An ability to apply knowledge of Mathematics, science and Engineering. | **PO1** |
| 2. An ability to identify, formulate and solve engineering problems. | **PO5** |
| 3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice. | **PO11** |

| Course delivery methods | Assessment methods |
|---|---|
| 1. Black board teaching | 1. Internal Assessment Tests |
| 2. Power point Presentation | 2. Assignments |
| 3. Scilab/ Matlab/ R-Software | 3. Quizzes |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of two Assignments/ Mathematical/Computational/Statistical tools of 4 labs in a semester | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20**

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## MANAGEMENT AND ENTREPRENEURSHIP

| | | | |
|---|---|---|---|
| **Course Code** | 16CV51 | **Credits** | 04 |
| **Course type** | HS | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 4-0-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. To explain the Characteristics of management, Role of Management, Importance and purpose of planning, Organizing, Staffing, directing and controlling.
2. To infer meaning of entrepreneur, Development of Entrepreneurship.
3. To outline Source of New Idea, Ideas into Opportunities. Creative Problem Solving.
4. To apply the aggregate planning strategies.
5. To Outline and explain of the different Schemes like Make in India, Start Up India, Digital India.

**Prerequisites**

**NIL**

**Detailed Syllabus**

### UNIT I

**Management**

Introduction, nature and characteristics of Management, Scope and Functional areas of management

**Planning**

Nature, importance and purpose of planning process, Types of plans, Decision making, Importance of planning, steps in planning

**Organizing**

Nature and purpose of organization, Principles of organization, Types of organization, Span of control, MBO

**08 Hours**

**Self-learning topics:** Management as a science, art of profession

## UNIT II

**Staffing, Directing & Controlling**

Nature and importance of staffing, Process of Selection and Recruitment, Training Methods

**Directing**

Meaning and nature of directing, Leadership styles, Motivation Theories, Communication- Meaning and importance

**Controlling**

Meaning and steps in controlling, Essentials of a sound control system, Methods of establishing control.

**08 Hours**

## UNIT III

**Entrepreneur**

Meaning of entrepreneur: Evolution of the concept: Functions of an Entrepreneur, Types of Entrepreneur, Concept of Entrepreneurship, Evolution of Entrepreneurship, The Entrepreneurial Culture and Stages in entrepreneurial process.

**Creativity and Innovation**

Creativity, Source of New Idea, Ideas into Opportunities, Creative Problem Solving: Heuristics, Brainstorming, Synaptic and Significance of Intellectual Property Rights.

**08 Hours**

**Self-learning topics:** Case studies of Entrepreneurs

## UNIT IV

**Micro, Small and Medium Enterprises [MSMEs] and Institutional Support**

Business environment in India**,** Role of MSMEs**,** Government policies towards MSMEs, Impact of Liberalization, Privatization and Globalization on MSMEs

**Institutional support**: NSIC, TECKSOK, KIADB, KSSIDC, SIDBI; KSFC

**08 Hours**

**Self-learning topics:** Make In India, Start Up India, Digital India

## UNIT V

**Preparation of Project report and Business Plan**

Meaning of Project, Project Identification, Project Selection, Project Report, Need and Significance of Report, Contents

**Business Plan**

Need of business plan, anatomy of business plan, executive summary, business description, Business environment analysis, background information.

**Venture Capital**

Meaning, Need, Types and Venture capital in India

**08 Hours**

**Self-learning topics:** Case studies on story of Silicon, Women Entrepreneur

**Text Books:**


1. Henry Koontz , " **Essentials of Management"** , Latest Edition
2. Poornima. M. Charantimath, **"Entrepreneurship Development",** Pearson Education, 2014 Edition onwards
3. Donald Kurtko and Richard, **"Entrepreneurship in new Millennium",** South Western Carnage Learning
4. Naidu N. V. R., **"Management and Entrepreneurship** ", IK International, 2008 Edition onwards
5. Tripathi P. C. and Reddy P. N., **"Principles of Management** ", Tata McGraw Hill.
6. Dr. Munshi M. M., Prakash Pinto and Ramesh Katri, **"Entrepreneurial Development",** Himalaya Publishing House, 2016 and onwards.


**Course Outcome (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | **Explain** the Functions of management, Characteristics of Management, Importance and Purpose of Planning, organizing staffing, directing and controlling | **L1** |
| 2 | **Explain** Meaning of entrepreneur, Development of Entrepreneurship and steps in developing entrepreneurship | **L2 L3** |
| 3 | **Describe** Source of New Idea, Ideas into Opportunities. Creative Problem Solving etc. | **L4** |
| 4 | **Describe** the different Schemes like TECKSOK, KIADB etc. and also Make In India, Start Up India, Digital India concepts | **L2 L3** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| 1 | An ability to communicate effectively | **PO7** |
| 2 | A recognition of the need for and an ability to engage in lifelong learning | **PO9** |
| 3 | An ability to use the techniques , skills, and modern engineering tools necessary for engineering practice | **PO11** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| Lecture | Assignments/case study presentation |
| Videos | Quizzes |
| PPT | Internal Assessment Tests |
| Field study | Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1 SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.

2 Minimum marks required in SEE to pass: 40 out of 100.

3 Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## ANALYSIS OF INDETERMINATE STRUCTURES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV52 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Explain Consistent Deformation Method and apply to analyze propped cantilever and fixed beams.
2. Analysis of continuous beams by Clapeyron's three moment theorem
3. Analyze the beams and frames by Slope deflection method
4. Evaluate the internal forces in indeterminate beams and frames by Moment Distribution method
5. Application of Kani's method for the analysis of indeterminate beams and frames**.**

**Pre-requisites**

1. Engineering Mechanics
2. Strength of Materials
3. Analysis of Determinate Structures

**Detailed Syllabus**

### UNIT I

**Consistent Deformation Method**

Analysis of propped cantilever and fixed beams for different loading conditions

**08 Hours**

## UNIT II

**Clapeyron's Three Moment Theorem**

Concept of Three moment theorem, Analysis of continuous beams for different loading and support conditions including settlement of supports.

**08 Hours**

## UNIT III

**Slope Deflection Method**

Introduction, Development of slope deflection equations, Analysis of beams (including settlement) and orthogonal rigid jointed plane frames (non sway) with kinematic redundancy not more than three (members to be axially rigid) for different loading and support conditions.

**Self Learning Topics**: Analysis of rigid jointed plane frames with sway.

**08 Hours**

## UNIT IV

**Moment Distribution Method**

Introduction, Definition of terms: Distribution factor, Carry over factor, Analysis of beams for different loading conditions with and without settlement of supports and orthogonal rigid jointed plane frames with kinematic redundancy not more than three (with and without sway).

**08 Hours**

## UNIT V

**Kani's Method**

Introduction, basic concept, Analysis of continuous beams and rigid jointed plane frames (two bay and two storeyed frames for non sway condition)

**08 Hours**

**Text Books**


1. Reddy C. S., **"Basic Structural Analysis",** Second Edition, Tata McGraw Hill Publication Company Ltd.
2. Bhavikatti S. S., **"Structural Analysis-II",** Vikas Publisher, New Delhi
3. Ramamurtham S. and Narayan R., **"Theory of Structures",** Dhanpat Rai Publishing company.


**References**


1. Devdas Menon, **"Advanced Structural Analysis",** Narosa Publications.
2. Wang C. K., **"Intermediate Structural Analysis'',** 5th Edition, Tata Mc Graw Hill Publication Company Ltd. 2014.
3. Stephen P. Timoshenko and Donvan H. Young**, "Theory of Structures'',** 2nd Edition, Tata McGraw Hill Publication Company Ltd.

**Course Outcome (COs)**

| | At the end of the course, students will be able to: | Bloom's Level |
|---|---|---|
| 1 | **Analyze** fixed and propped beams**.** | **L4** |
| 2 | **Evaluate** the moment at the supports by Clapeyron's method and sketch the BMD and SFD**.** | **L3 L5** |
| 3 | **Analyse** the beams and frames by Slope deflection method and sketch the BMD and SFD**.** | **L3 L4** |
| 4 | **Apply** Moment Distribution method for the analysis of beams and frames. | **L3 L4** |
| 5 | **Solve** the indeterminate beams and frames by Kani's Method and sketch the BMD and SFD | **L3** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2 | Graduates shall possess the ability to review the research literature and analyze complex engineering problems. | **PO2** |
| 3 | Graduates shall be able to design and conduct experiments and interpret the results as per the current research. | **PO4** |
| 4 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO5** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

| | Course delivery methods | | Assessment methods |
|---|---|---|---|
| 1. | Lecture and Board | 1. | Assignments and Open Book Assignment |
| 2. | NPTEL/ Edusat | 2. | Quizzes |
| 3. | Power Point Presentation | 3. | Internal Assessment Tests |
| 4. | Videos | 4. | Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.

2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

**DESIGN OF RCC STRUCTURAL ELEMENTS**

| | | | |
|---|---|---|---|
| **Course Code** | 16CV53 | **Credits** | 04 |
| **Course type** | PC | **CIE Mark** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Enable comprehensive understanding of Reinforced Cement Concrete (RCC)
2. To introduce concept of RC Structures, constituent materials of RCC and their properties behavior.
3. Explain different design philosophies
4. To provide in-depth knowledge of design concepts/principles of various structural components of a building like beam, column, slab, staircase and footing.

**Pre-requisites**

1. Engineering Mechanics
2. Strength of Materials
3. Structural Analysis
4. Concrete Technology

**Detailed Syllabus**

**UNIT I**

**General Features of Reinforced Concrete**

Introduction, Materials for Reinforced Concrete, Stress-Strain relationship for concrete and steel, Different design philosophies (WSM/LSM/ULM). Different limit states as per IS 456-2000, Loads as per IS 875, Partial factors of safety, Characteristic and design loads, Characteristic and design strengths. Codal provisions

**Limit State of Collapse (Flexure)**

Stress block parameters for limit state of collapse, Concept of under reinforced, over reinforced and balanced sections, Ultimate flexural strength of singly and doubly reinforced rectangular sections. Ultimate flexural strength of flanged sections

**08 Hours**

**UNIT II**

**Design Concepts of Beams**

Design of singly and doubly reinforced rectangular sections for flexure, design of flanged sections for flexure. Codal provisions for flexural reinforcements and practical considerations. General aspects of

serviceability limit states-Deflection and cracking as per IS: 456 – 2000.Calculations of short term deflection

**08 Hours**

**UNIT III**

**Limit State of Collapse (Shear and Torsion)**

Behavior of RC sections under shear, Critical sections for shear, Design concepts with codal recommendations, Ultimate shear strength of RC sections, Design of beams for shear, Design of beams for combined flexure, shear and torsion.

**Self Learning Topics:** Concepts of bond, development length and anchorage.

**08 Hours**

**UNIT IV**

**Design of Slabs**

General design considerations as per IS 456-2000, Design of one way simply supported slab, continuous slab and cantilever slab, Rectangular simply supported and restrained slabs spanning in two directions for various boundary conditions as per IS: 456 – 2000.

**Design of stair case**

Design of longitudinally spanning dog legged stair cases

**08 Hours**

**UNIT V**

**Limit State of Collapse (Compression)**

**Design of columns**

General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity, Codal provisions, design of short axially loaded columns, design of column subject to combined axial load and uniaxial moment using SP–16.

**Design of footings**

Introduction, load on footing, Design basis for limit state method, Design of isolated square / rectangular footing for axial load and axial load with uniaxial moment.

**08 Hours**

**Text Books**


1. Varghese P. C., **"Limit State Design of Reinforced concrete",** PHI Learning Private Limited 2008-2009.
2. Gambhir M. L., **"Fundamentals of Reinforced Concrete Design",** PHI Learning Private Limited 2008-2009.
3. Krishnaraju N. and Pranesh R. N.**, "Reinforced Concrete Design",** New Age International Publications, New Delhi.
4. Karve and Shah**, "Limit State Theory and Design of Reinforced Concrete"**, 8th Edition, Structures Publications, Pune.

5. Bhavikatti S. S.**, "Design of RCC Structural Elements Volume I",** New Age International Publications, New Delhi

**References**


1. Sinha S. N.**, "Reinforced concrete Design",** TMH Education Private Limited.
2. Unnikrishna Pallai and Devdas Menon**, "Reinforced Concrete Design",** TMH Education Private Limited.
3. IS456-2000 and SP-16


**Course Outcome (COs)**

| At the end of the course, the student will be able to: | Bloom's Level |
|---|---|
| 1. **Comprehend** the design concepts of RCC. | **L2** |
| 2. **Analyse** the given RC sections for strength and serviceability | **L4** |
| 3. **Evaluate** the ultimate strength of RC sections in flexure, shear and torsion. | **L5** |
| 4. **Recognize** and **adopt** codal provisions with due practical considerations. | **L2** |
| 5. **Apply** the acquired knowledge for the design of RC structural components**.** | **L3** |

**Program Outcome (POs)**

| | |
|---|---|
| 1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2. Graduates shall be able to design and conduct experiments and interpret the results as per the current research. | **PO4** |
| 3. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO5** |
| 4. Graduates shall possess effective oral and written communication skills. | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

## Scheme of Continuous Internal Evaluation (CIE)

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE)**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## HIGHWAYS AND AIRPORT ENGINEERING

| | | | |
|---|---|---|---|
| **Course Code** | 16CV54 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 –1– 0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. Gain the knowledge of different modes of transportation, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.
5. Design and plan airport layout.

**Pre-requisites**:
**NIL**

**Detailed Syllabus**

### UNIT 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, Central Road Research Institute Highway

**Development and Planning**

Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th Twenty year road development plans, Road development plan - vision 202

**08 Hours**

**Self-Learning Topic:** Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL)

**UNIT II**

**Highway Alignment and Surveys**

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

**Highway Geometric Design**

Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curve

**08 Hours**

**UNIT III**

**Pavement Materials**

Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material

**Pavement Design**

Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples

**08 Hours**

**UNIT IV**

**Highway Drainage**

Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

**Highway Economics**

Highway user benefits, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.

**08 Hours**

## UNIT V

**Airport Planning**

Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

**Runway Design:** Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length

**08 Hours**

**Text Books:**


1. Khanna S. K., Justo C. E. G. and Veeraragavan A., "Highway Engineering", Nemchand and Bros. Roorkee, Revised Tenth Edition, 2015.
2. Khanna S. K., Arora M. G. and Jain S. S., "Airport Planning and Design", Nemchand and Brothers, Roorkee.
3. L. R. Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
4. R. Srinivasa Kumar, "Highway Engineering", University Press.
5. K. P. Subramanium, "Transportation Engineering", SciTech Publications, Chennai.
6. C Venkatramaiah, "Transportation Engineering", Volume I: Highway Engineering, Universities Press.


**References:**


1. Relevant IRC Codes
2. Specifications for Roads and Bridges- MoRT & H, IRC, New Delhi.
3. C. JotinKhisty, B. Kent lal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.


**Course Outcome (COs)**

| | At the end of the course students will be able to | Bloom's Level |
|---|---|---|
| 1. | Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data. | **L1 L2** |
| 2. | Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction. | **L2 L3** |
| 3. | Design road geometrics, structural components of pavement and drainage. | **L3** |
| 4. | Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts. | **L1 L3** |
| 5. | Develop layout plan of airport | **L3** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | **PO1** |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first | **PO2** |

principles of mathematics, natural sciences, and engineering sciences

| | | |
|---|---|---|
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | **PO3** |
| 4 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| | Course delivery methods | | Assessment methods |
|---|---|---|---|
| 1 | Lecture and Board | 1 | Assignments and Open Book Assignment |
| 2 | NPTEL/ Edusat | 2 | Quizzes |
| 3 | Power Point Presentation | 3 | Internal Assessment Tests |
| 4 | Videos | 4 | Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## HYDROLOGY AND IRRIGATION ENGINEERING

| | | | |
|---|---|---|---|
| **Course Code** | 16CV55 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. Define different components of hydrology. Measure, estimate and interpret missing rainfall data.

2. Define different components of hydrology. Measure and estimate water losses.
3. Develop storm hydrograph and unit hydrograph with the available stream flow data.
4. Define irrigation. Explain types and methods of irrigation. Estimate crop water requirement for determining storage capacity of reservoir.
5. Acquire the knowledge of Irrigation management including conveyances.
6. Design of storage structures, canal head works, outlet for reservoirs.

**Pre-requisites:**

1. Fluid Mechanics
2. Hydraulics

**Detailed Syllabus**

**UNIT I**

**Precipitation**

Introduction, Hydrologic cycle (Horton's representation). Water budget equation Precipitation: introduction, forms of precipitation, types of precipitation, measurement of precipitation (Simon's gauge & Syphon gauge only), selection of rain gauge station. Adequacy of raingauges, methods of computing average rainfall, interpolation of missing data, Adjustment of missing data by double mass curve method. Hyetograph and mass curve of rainfall

**08 Hour**

**UNIT II**

**Water Losses**

Infiltration, factors affecting infiltration, measurement of infiltration, Horton's infiltration curves, infiltration indices, Evaporation, factors affecting evaporation, measurement of evaporation, Blaney-Criddle method

**Runoff**

Components, factors affecting runoff, basin yield, rainfall – runoff relationship using simple regression analysis, computation of maximum discharge by Dicken's formula and rational formula. Estimate the flood discharge using empirical formulae for a given catchment.

**08 Hours**

**UNIT III**

**Hydrograph**

Components of a hydrograph, separation of base flow, unit hydrograph theory, derivation and application of unit hydrograph, computation of unit hydrograph, unit hydrograph of different duration, S-curve and it use.

**Ground water hydrology**

Importance and occurrence of ground water, definition of terms, aquifers, aquitard, aquifuge, aquiclude, Darcy's law and its validity, steady radial flow into a well in confined and unconfined aquifers

**08Hours**

## UNIT IV

**Introduction to irrigation**

Definition. Benefits and ill effects of irrigation. Source of water for irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, bhandra irrigation. Methods of irrigation in India potential and development. Definition of consumptive use

**Water Requirement of crops**

Duty, delta and base period, relationship between duty,delta and base period, factors affecting duty of water crops and crop seasons in india, irrigation efficiency, frequency of irrigation. Assessment of irrigation water

**08Hours**

**Self Learning Topics**: Assessment of irrigation water

## UNIT V

**Canals**

Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method - Problems

**08 Hours**

**Text Books**


1. Subramanya.K, "**Engineering Hydrology**"; Tata McgrawHill NewDelhi-2008 (Ed)
2. Madan Mohan Das , "**Hydrology**" , PHI Learning private Ltd. New Delhi-2009 (Ed)
3. Jayarami Reddy , "**A Text Book Of Hydrology**", Laksmi Publications, New Delhi-2007 (Ed)
4. P.N.Modi, "**Irrigation, water Resources and water power Engineering**", Standard book house, New Delhi.
5. Madan Mohan Das, "Irrigation and Water Power Engineering", PHI Learning pvt. Ltd. New Delhi 2009 (Ed).


**Reference Books**


1. Ghanshyam Das , "**Hydrology & Soil Conservation Engineering**", PHI Learning Private Ltd., New Delhi- 2009 (Ed)
2. Patra K.C ,"**Hydrology & Water Resources Engineering**" , Narosa Book Distributors Pvt. Ltd. New Delhi-2008 (Ed)
3. R.K.Sharma, "**Hydrology & Water Resources Engineering**", Oxford and IBh, New Delhi
4. S. K. Garg, "**Irrigation Engineering and Hydraulic structures**", Khanna Publication, New Delhi.


**Course Outcome (COs)**

| **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|
| 1. **Estimate** the quantity of precipitation available for a given catchment | **L5** |

| | | |
|---|---|---|
| 2. | **Determine** the rain gauge network and compute the average depth of rain fall over a basin | **L3** |
| 3. | **Predict** the surface runoff based on hydrograph theory | **L2** |
| 4. | **Solve** for aquifer parameters | **L3** |
| 5. | **Design** the regime canals for irrigation and other purposes | **L6** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2. | Graduates shall possess the ability to review the research literature and analyse complex engineering problems. | **PO2** |
| 3. | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO3** |
| 4. | Graduates shall be able to design and conduct experiments and interpret the results as per the current research. | **PO4** |
| 5. | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO5** |
| 6. | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability. | **PO7** |
| 7. | Graduates shall learn to apply the principles of engineering and management in multidisciplinary environment. | **PO11** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. Power-point Presentation | 2. Quizzes |
| 3. Videos | 3. Internal Assessment Tests |
| 4. NPTEL / Edusat | 4. Semester End Examination (SEE) |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

| |
|---|
| Two IA tests are compulsory.<br><br>**Minimum marks required to qualify for SEE : 20** |

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## ELECTIVE I
## THEORY OF ELASTICITY

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV561 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3 – 0 – 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

3. To learn principles of Analysis of Stress and Strain
4. To predict the stress-strain behavior of continuum.
5. To understand the stress and strain parameters and their inter-relationship.
6. To solve axi-symmetric problems.
7. To solve stress concentration problems in rectangular plates with a hole.
8. To explain the concepts of torsion for non-circular sections

**Pre-Requisites:**

3. Engineering Mechanics
4. Strength of Materials
5. Structural Analysis

### UNIT I

Introduction to elasticity, State of stress at a point. Differential equations of equilibrium in Cartesian co-ordinates for 2-D and 3-D problems. State of strain at a point, Components of strain at a point. Constitutive relations, Compatibility equations in terms of strains

**08 Hours**

### UNIT II

Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain

**08 Hours**

**Self Learning Topic:** Strain rosettes

### UNIT III

Plane stress and plane strain. Compatibility equation for plane state of stress and strain. Airy's stress function approach to 2-D problems of elasticity

**08 Hours**

**UNIT IV**

Differential equations of equilibrium in polar co-ordinates, Compatibility equation in terms of Airy's stress function in polar co-ordinates Solution of axi-symmetric problems- Stresses in Thick cylinders

**08 Hours**

**UNIT V**

Effect of circular hole on stress distribution in plates subjected to tension, compression and shear. Stress concentration factor.

Torsion of non-circular sections- St.Venant's theor y, Prandtl's stress function, Membrane analogy, Torsion of thin walled tubes, torsion of thin walled multiple cell closed sections.

**08 Hours**

**Text Books**


5. Timoshenko and Goodier, " **Theory of Elasticity**", Third Edition McGraw Hill 2010
6. Sadhu Singh, " **Theory of Elasticity**", Third Edition Khanna Publishers New Delhi 2014
7. Valliappan C, " **Continuum Mechanics Fundamentals**", First Edition Oxford IBH Publishing Co. Ltd 1981.
8. Srinath L.S **"Advanced Mechanics of Solids"** , Third Edition, Tata McGraw Hill Publishing company, New Delhi, 2009


**References**


1. Srinath L.S., Verma P.D.S, "**Theory of Elasticity**", Second Edition Vikas Publishing Pvt. Ltd New Delhi 1997
2. Sadhu Singh, " **Applied Stress Analysis**", Fourth Edition Khanna Publishers New Delhi 2000
3. Xi Lu, " **Theory of Elasticity**", Second Edition, John Wiley 2000.
4. Kazimi S. M. A., **"Solid Mechanics" ,** First Edition Tata McGraw Hill Education Pvt. Ltd New Delhi 1997


**Course Outcomes (COs)**

| | At the end of the course, students will be able to | Bloom's Level |
|---|---|---|
| 1 | **Describe** the concepts of stress and strain | **L2** |
| 2 | **Develop** Airy's stress function and **Evaluate** the stresses and forces for 2-D problems | **L3 L5** |
| 3 | **Solve** for stresses for axi-symmetric problems like thick cylinders | **L3** |
| 4 | **Evaluate** stress concentration factor for practical problems | **L5** |
| 5 | **Apply** the concepts of torsion theory for non circular sections | **L3** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall conceptualize and obtain feasible and optimal solution for engineering problems considering societal and environmental requirements (lateral thinking) | **PO3** |
| 3 | Graduates shall be able to adopt modern techniques, analytical tools and software for complex engineering problems | **PO5** |

| | | |
|---|---|---|
| 4 | Graduates shall possess communication skills to comprehend, document and present effectively to the engineering community and society at large | **PO8** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| Two IA tests are compulsory.<br><br>Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50 | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

4. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
5. Minimum marks required in SEE to pass: 40 out of 100.
6. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## OPEN CHANNEL HYDRAULICS

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV562 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3 – 0 – 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Describe the geometric elements of open channel flow and apply the concepts for uniform flow problems.
2. Analyse problems related to channel section including practical applications.
3. Illustrate the basic concepts of specific energy and critical flow.
4. Outline the methods of gradually varied flow computations for practical problems.

5. Demonstrate the principles of specific force in hydraulic jump problems and its applications

**Pre-Requisites:**

1. Fluid Mechanics
2. Hydraulics and Hydraulic Machines

**Detailed Syllabus**

**UNIT I**

Introduction. Difference between open channel flow and pipe flow. Types of Channels. Classification of flows. Velocity distribution. Energy equation, momentum equation, kinetic energy and momentum factors

Uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels for uniform flow

**08 Hours**

**UNIT II**

Concept of specific energy. Specific energy curve. Criterion for critical flow. Calculation of critical depth. Section factor and hydraulic exponent. Transitions – Channels with hump and transitions with change in width

**08 Hours**

**UNIT III**

Introduction to Gradually varied flow. Differential equation of GVF. Classification of channel bottom slopes. Classification and Characteristics of surface profiles

**08 Hours**

**UNIT IV**

Gradually Varied Flow Computations: Different methods, direct integration method, Bresse's Solution, Chow's solution, direct method, standard step method.

**08 Hours**

**UNIT V**

Introduction to hydraulic jump. Momentum equation for the jump. Hydraulic jump in rectangular channels. Classification of hydraulic jumps. Characteristics of hydraulic jump in rectangular channel and on sloping floor

**08 Hours**

**Self Learning Topic:** Hydraulic jump in non rectangular sections

**Text Books:**


1. Subramanya, " **Open Channel Hydraulic**", Tata Mc Graw Hill Publishing Co Ltd, New Delhi
2. Madan Mohan Das, "**Open Channel Flow**", Prentice Hall of India Pvt. Ltd., New Delhi 2008 Edition.
3. Rajesh Srivastava, "**Flow Through Open Channels**", Oxford Press, New Delhi 2008 Edition.


**References:**


1. French, "**Open Channel Hydraulics**", McGraw Hill Book Company, New Delhi.
2. Modi and Seth, "**Fluid Mechanics**", Standard Book Home, New Delhi.
3. Henderson, "**Open Channel Hydraulics**", Mr. Milan Publishing Co. Ltd., New York.
4. Ven Te Chow , " **Open Channel Hydraulics**", McGraw Hill Book Company, New Delhi


**Course Outcomes (COs)**

**Bloom's Level**

**At the end of the course, students will be able to:**

1. **Outline** the types of channels and **Summarize** the classification of flows — **L2**

2. **Solve** and **Evaluate** the geometric elements of open channel flow **L3 L5**
3. **Summarize** the concept of specific energy and **Solve** for critical depth for various types of channel sections **L2 L3**
4. **Develop** various types of surface profiles and **Solve** for length of gradually varied flows by various methods **L3**
5. **Make use of** the principles of specific force in hydraulic jump problems and its applications for practical problems **L3**

**Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering **PO1**
2. Graduates shall be able to design and conduct experiments and interpret the results as per the current research **PO4**
3. Graduates shall be able to adopt modern techniques, analytical tools and software for complex engineering problems **PO5**
4. Graduates shall possess effective oral and written communication skills **PO10**

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |
| Two IA tests are compulsory.<br>Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50 | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## AIR POLLUTION AND CONTROL

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV563 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3 – 0 – 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

6. Understand the objectives, importance of air pollution and its control.
7. Explain the effects of air pollution on human health, plants and materials.
8. Understand the importance of Electrostatic precipitators, fabric filters and cyclone separators for industries.
9. Describe the environmental concerns due to global warming, greenhouse effect and acid rain.
10. Outline the Air quality and emission standards - legislation and regulation.

**Pre-Requisites:**

**1.** Environmental Studies

**Detailed Syllabus**

### UNIT I

**Introduction**

Definition, Classification and properties of Air pollutants, Primary and secondary Air pollutants, Concentrations of Air pollutants and sources, behaviour and Fate of Air Pollution: Chemical reaction in the Atmosphere, photochemical Smog.

**Effects of Air Pollution**

On Human Health, Animals, Plant and properties, Major Episodes- London smog, Bhopal gas tragedy.

**08 Hours**

**Self Learning Topic:** Los Angeles Smog

### UNIT II

**Atmospheric Stability**

Introduction**,** Meteorological Variables. Lapse Rate-Adiabatic- Dispersion/ inversion, Stability Conditions, windrows diagram, General characteristics of stack plumes.

**08 Hours**

### UNIT III

**Sampling and Analysis of Air Pollutants**

Sampling and measurement of Gaseous and particulate pollutants stack sampling, smoke and its measurements.

**Control of Air Pollutants**

Control methods - Particulate emission control, gravitational settling chambers, cyclone separators, fabric filters, Electrostatic precipitators, wet scrubbers, control of gaseous emissions.

**08 Hours**

## UNIT IV

**Air Pollution due to Automobiles**

Air pollution due to gasoline driven and Diesel driven engines, effects, control - direct and indirect methods

**Standards and Legislation**

Air quality and emission standards - legislation and regulation, Air pollution index, BS-3 and BS-4 regulation norms, Pollution control board norms for air pollution

**08 Hours**

## UNIT V

**Global Environmental Issues**

Acid rain, Green House effect, Global warming, Ozone layer Depletion, Factors to be considered in industrial plant locations and planning, Noise pollution and its effects, Heat Island effects, Indoor air pollution.

**08 Hours**

**Text Books:**


4. Rao M.N., **"Air Pollution"** , Tata McGraw Hill
5. George Tchobanoglous, Howard S. Peavy, Donald R. Rowe, **" Environmental Engineering",** Tata McGraw Hill Publishing Co Ltd. 1st Edition 2013


**References**


5. Rao C.S., **"Environmental pollution control"**, Wiley Eastern Ltd.
6. Stem A., **"Air Pollution"**, Academic Press, Vol. I to IV
7. Henry P., **"Air pollution"** , Tata McGraw Hill


### Course Outcome (COs)

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | **Justify** the importance of Public Health Engineering for the Society. | **L5** |
| 2. | **Identify** the effects on human health, plants and materials due to air pollution disasters. | **L2** |
| 3. | **Explain** the sampling procedure and meteorology parameters. | **L2** |
| 4. | **Justify** the advantages of air pollution control devices. | **L5** |
| 5 | **Explain** guidelines for discharging air pollutants into atmosphere from industries | **L2** |

### Program Outcomes (POs)

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and Scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues | **PO3** |
| 3 | Graduates shall be able to understand contemporary societal issues to address them professionally. | **PO6** |
| 4 | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability. | **PO7** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

Two IA tests are compulsory.
Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## TRAFFIC ENGINEERING

| | | | |
|---|---|---|---|
| **Course Code** | 16CV564 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 –0 – 0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

### Course learning objectives (CLOs)

1. To learn the fundamentals of Traffic Engineering, concepts and scope.
2. To understand the insights of road user and vehicular characteristics and their influence on traffic engineering parameters.
3. To gain the knowledge of data collection, sampling, analysis of data of various surveys of traffic engineering.

4. To gain the knowledge of parking logistics and to learn the fundamentals of accident analysis.
5. To understand the fundamentals of Congestion, Fuel consumption, toll operation and ITS.

**Pre-requisites:**

1. Highway Engineering

**Detailed Syllabus**

**UNIT I**

**Introduction**

Definition, Objectives, Scope of Traffic Engineering, Road user and Vehicle characteristics, Static and Dynamic characteristics, Power performance of the vehicles,

Resistances to the motion of vehicles, Reaction time of driver-Problems on above, PCU and Factors affecting PCU

Traffic Measurement Procedures

Measurement at a point: Traffic volume measurement, equipment for flow measurement, Data analysis, concepts of ADT and AADT

Measurement over a short section: Speed measurement, $15^{th}$ and $85^{th}$ Percentile speed, Design Speed, Speed distributions

Measurement along a length of road: density measurement, Travel time measurement

**08 Hours**

**Self-learning topics:** Presentation of Traffic Volume Data in different forms.

**UNIT II**

**Traffic Flow Theories**

Green Shield Theory-Goodness of fit, Correlation and regression analysis, (linear only), Queuing theory, Car following theory, Lane changing theory and problems on above **Uninterrupted Flow:** Capacity and level of service, urban street, multilane highways, Freeway operations.

**08 Hours**

**UNIT III**

**Parking and Accident Analysis**

Parking, On Street and Off Street Parking studies and configuration, design of layout, Accident, Causes, Data Collection and Analysis, Derivation for collision, Collision and condition diagrams (right angle collision only with parked vehicle), Measures to reduce accidents, Problems on above.

Field Data Collection and Analysis related to Accidents.

Arboriculture

**08 Hours**

## UNIT IV

**Traffic Regulation and Control**

Driver, Vehicle, and road Controls, Traffic Regulation, one way, Traffic Signs, Road Markings, Traffic Signals, Advantages and disadvantages of Traffic Signals. Vehicle actuated and Synchronized signals, Webster's method of Signal Design, IRC Method, Relevant Problems on above. (No problems on vehicle actuated signals)

**08 Hours**

## UNIT V

**Fuel Consumption and emission studies**

Definitions of Fuel Efficiency, Fuel Consumption, Air pollution, Automobile pollution, Types of Vehicular Emissions, Bharat Stage Emission Standards

**Congestion studies**

Generation of Traffic Congestion, effects of Congestion, Traffic Congestion-Types.

**Toll operation**

Types and Methods, Toll pricing, Factors affecting Toll rates **ITS-Intelligent Transportation Systems-** ITS User Services in brief. **Traffic Parameter Studies II**

Manual and automatic Counters, Spot Speed studies and analysis (Mid block), Moving Car method for delay studies and Problems on above

**08 Hours**

**Text Books:**


1. Khanna S. K., Justo C. E. G. and Veeraragavan A., "**Highway Engineering**", Nemchand and Bros. Roorkee, Revised Tenth Edition, 2015.
2. Kadiyali L. R., "**Traffic Engineering and Transportation Planning**", Khanna Publishers. VII Edition, 2011
3. Matson, Smith and Hurd, "**Traffic Engineering**", McGraw Hill and Co, III Edition, 2003.
4. Sharma S. K., "**Principles, Practice and Design of Highway Engineering",** S. Chand and Co. 3rd Edition, 2015.


**References:**


1. Jotin Khistey and Kentlal, "**An Introduction to Traffic Engineering**", PHI.
2. Pingnataro G. J., " **Principles of Traffic Engineering**", Tata McGraw-Hill, (1970)
3. **"Highway Capacity Manual** ", Transportation Research Board, USA, -(2000)


**Course Outcome (COs)**

| At the end of the course students will be able to | Bloom's Level |
|---|---|
| 1. **Explain** the Scope of Traffic Engineering, objectives and some basic definitions. | **L2** |
| 2. **Discuss** the road user characteristics and vehicular characteristics and data collection of different traffic surveys and **analysis** of data | **L2 L4** |

| | | |
|---|---|---|
| 3. | **Summarizing** parking Studies and accident studies and **reporting** of accident details | **L3** |
| 4. | **Describe the** traffic regulations and controls | **L2** |
| 5. | **Describe** and **Design** the various aspects of traffic signal by different methods | **L2 L6** |
| 6. | **Explain** the uses of ITS**.** | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall conceptualize and obtain feasible and optimal solution for engineering problems considering societal and environmental requirements (lateral thinking) | **PO3** |
| 3. | Graduates shall be able to adopt modern techniques, analytical tools and software for complex engineering problems | **PO5** |
| 4. | Graduates shall be able to understand contemporary societal issues to address them professionally**.** | **PO6** |
| 5. | Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth | **PO12** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| | **Course delivery methods** | | **Assessment methods** |
|---|---|---|---|
| 1. | Lecture and Board | 1. | Assignments and Open Book Assignment |
| 2. | NPTEL/ Edusat | 2. | Quizzes |
| 3. | Power Point Presentation | 3. | Internal Assessment Tests |
| 4. | Videos | 4. | Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| Two IA tests are compulsory.<br>Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50 | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## HIGHWAY ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL57 | **Credits** | 01 |
| **Course type** | PC | **CIE Marks** | 25 marks |
| **Hours/week: L-T-P** | 0-0-2 | **SEE Marks** | 25 marks |
| **Total Hours:** | 36 | **SEE Duration** | 3 Hours for 25marks |

**Course learning objectives (CLOs)**

1. To conduct basic tests on properties of road aggregates.
2. To conduct the basic test on properties of bitumen.
3. To find the strength of the soil subgrade.
4. To interpret the results with standard IRC specifications

**Pre-requisites:**

1. Concrete lab
2. Geotechnical engineering lab

**List of experiments**

**Test on road aggregates**

1. Specific gravity and water absorption test
2. Aggregate impact test
3. Los Angeles abrasion test
4. Aggregate Crushing test
5. Shape test

a. Flakiness test
b. Elongation test
c. Angularity number test

6. Soundness test or durability test
7. Polished stone value test or accelerated polishing test

**Test on bitumen**

8. Penetration test
9. Ductility test
10. Viscosity test
11. Float test
12. Flash and fire point test
13. Specific gravity test
14. Softening point test
15. Loss on heating test
16. Water content test
17. Solubility test

**Test on bituminous mix**

18 Aggregates proportioning by Rothfutch's method
19 Marshall stability t

**Test on soil subgrade**

20. California Bearing Ratio test

**Reference books**:


1. Khanna S. K., C. E. G. Justo and Veeraragavan A., "Highway Engineering", Nemchand and Bros. Roorkee, Revised Tenth Edition, 2015
2. .**Soil Mechanics and Foundation Engg**.-Punmia B.C. (2005), 16th Edition Laxmi Publications Co. , New Delhi
3. Khanna S. K., C. E. G. Justo and Veeraragavan A "Highway Engineering laboratory manual", Nemchand and Bos


**.Course Outcome (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| **1** | To **analyze** the results from the experiments and to interpret the results with standard value | **L4** |
| **2** | To **compare** the properties of different materials available for pavement construction with relevant code books provisions | **L2 L6** |
| **3** | To **analyze** the causes & failures of pavements | **L4** |
| | **Program Outcomes (POs)** | |
| **1** | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| **2** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools | **PO5** |
| **3** | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability | **PO7** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

1. Continuous evaluation of conduct of Practicals and Journals
2. Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

1. **Minimum marks required for eligibility for SEE: 13 out of 25**
2. **Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE)**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## COMPUTER AIDED DESIGN AND DRAWING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL58 | **Credits** | 02 |
| **Course type** | PC | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 0-0-3 | **SEE Marks** | 25 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1. To understand the basic commands of AutoCAD. [L2]

2. To plan residential & public buildings according to bye-laws and draw using AutoCAD. To plan building components like footings, stairs, doors and windows and design of water supply, sanitation and electrification for a building using AutoCAD. [L3]
3. To understand the basic commands used in Excel and to analyse simply supported, cantilever beam problems using Excel.

**Pre-requisites:**

1. Building Materials and Construction Technology.
2. Building planning and drawing.
3. Strength of Materials.

**1. Introduction to AutoCAD**

Drawing Basics: Drawing tools : Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations. Simple engineering drawings with CAD

**10 Hours**

**2. Preparation of drawings**

Drawings Related to Different Building Elements: Following drawings are to be prepared for the data given using CAD Software a) Cross section of Foundation, masonry wall, RCC columns with isolated footings. b) Dog legged staircase c) Lintel and chajja d) RCC slabs and beams e) Cross section of a pavement f) Septic Tank g) Layout plan of Rainwater recharging and harvesting system h) Steel truss (connections Bolted) Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing

**20 Hours**

**3. Use of Excel in Civil Engineering Problems**

Use of spreadsheet for the following civil engineering problems:

i) SFD and BMD for Cantilever and simply supported beam subjected to UDL and UVL acting throughout the span.
ii) Design of singly reinforced and doubly reinforced rectangular beams.
iii) Computation of earthwork.
iv) Design of horizontal curve by offset method
v) Design of super elevation

**10 Hours**

**Text books:**


1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing" , Tata Mc Graw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "Civil Engineering Drawing" , Asian Publishers/Computech Publications Pvt Ltd.


**Reference Books:**


1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
3. National Building Code, BIS, New Delhi.

## Course Outcomes (COs)

| At the end of the course, students will be able to: | Bloom's Level |
|---|---|
| 1. Plan residential and commercial buildings following the principles of planning in AutoCAD | **L3** |
| 2. Plan building components like footings, stairs, doors and windows , design of Water supply, sanitation and electrification for the buildings in AutoCAD | **L3** |
| 3. Use Excel spreadsheet to solve the Civil engineering problems | **L2** |

## Program Outcomes (POs)

| | |
|---|---|
| 1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts | **PO1** |
| 2. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

**# Minimum CIE marks required for eligibility for SEE: 13 out of 25**

**# Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## SEMESTER VI
## SOIL MECHANICS

| Course Code | 16CV61 | Credits | 04 |
|---|---|---|---|
| Course Type | PC | CIE Marks | 50 |
| Hours/week: L-T-P | 3-1-0 | SEE Marks | 50 |
| Total Hours | 40 | SEE Duration | 03 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. To define and determine and the index properties of soil.
2. To understand the particle size distribution and learn the different methods of soil classification.
3. To understand the concepts of flow through soils and application of Darcy's law and Laplace equation.
4. To evaluate and understand the concept of shear strength of soils.
5. To understand Terzaghi's one dimensional consolidation theory and pre-consolidation pressure and its determination by Casagrande method.

**Pre-requisites**

1. Strength of Materials
2. Fluid Mechanics

**Detail Syllabus**

### UNIT I

**Introduction and Index Properties of Soil**

History of soil mechanics, Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Densities and Unit weights - Bulk, Dry, Saturated & Submerged and their inter-relationships.

Index Properties of soil- Water content , Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, in-situ density, Laboratory methods of determination of index properties of soil: Water content (oven drying method), Specific gravity of soil solids (Pycnometer and density bottle method), Particle size distribution (Sieve analysis only), Liquid Limit- (Casagrande method), Plastic limit and shrinkage limit determination.

**08 Hours**

### UNIT II

**Classification and Compaction of Soils**

Purpose of soil classification, Particle size classification –Textural classification. IS classification - Plasticity chart and its importance. Field Identification of fine grained soils

Definition of compaction, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, field compaction and its control.

**08 Hours**

**Self Study:** Study of field compaction equipment

### UNIT III

**Flow of Water through Soils and Flow Nets**

Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory methods), factors affecting permeability, permeability of stratified soils, quick sand phenomena.

Laplace equation (no derivation) assumptions and limitations only, characteristics and uses of flownets, Methods of drawing flow nets for sheet piles. Estimating quantity of seepage, seepage pressure and Exit gradient. Determination of phreatic line in earth dams with and without filter. Piping- causes and control.

**08 Hours**

## UNIT IV

**Shear Strength of Soil**

Concept of shear strength, Mohr-coulomb theory, conventional and modified failure envelopes, Effective stress principle, calculation of total stress, effective stress and neutral stress, Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils, Measurement of shear parameters- Direct shear test, unconfined compression test, Triaxial compression test and vane shear test, Tests under different drainage conditions.

**08 Hours**

**Self Study:** calculation of total stress, effective stress and neutral stress

## UNIT V

**Consolidation of Soil**

Definition of consolidation, spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande 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 (square root of time fitting method, logarithmic time fitting method)

**08 Hours**

**Text Books**


1. Punmia B. C., **"Soil Mechanics and Foundation Engineering"** (2005), 16th Edition Laxmi Publications Co., New Delhi.
2. Murthy V. N. S., **"Principles of Soil Mechanics and Foundation Engineering",** (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
3. Gopal Ranjan and Rao A. S. R., **"Basic and Applied Soil Mechanics",** (2000), New Age International (P) Ltd., New Delhi.
4. Venkatramaiah C., **"Geotechnical Engineering",** Universities Press. Hyderabad.


**References**


1. Braja M. Das, **"Geotechnical Engineering",** (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India
2. Alam Singh and Chowdhary G. R., "**Soil Engineering in Theory and Practice",** (1994), CBS Publishers and Distributors Ltd., New Delhi.
3. Bowles J. E., **"Foundation Analysis and Design",** (1996), 5th Edition, McGraw Hill Pub. Co., New York
4. Donold P. Coduto, **"Geotechnical Engineering",** PHI Learning Private Limited, New Delhi
5. Gulathi K. and Manoj Datta, **"Geotechnical Engineering",** Shashi (2009), Tata McGraw Hill.


### Course Outcome (COs)

**At the end of the course, students will be able to:**

| | | Bloom's Level |
|---|---|---|
| 1 | **Define** and **Determine** basic properties of soil | **L1 L5** |
| 2 | **Classify** the soils as per Indian standards | **L2** |
| 3 | **Determine** permeability of soil and **Estimate** quantity of seepage | **L5** |
| 4 | **Analyze** shear parameters of soil by different methods | **L4** |
| 5 | **Explain** concept of compaction and consolidation | **L5** |

. **Program Outcomes (POs)**

1. Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering **PO1**
2. Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures **PO3**
3. Graduates shall be able to adopt modern techniques, analytical tools and software for complex engineering problems **PO5**
4. Graduates shall possess effective oral and written communication skills **PO10**

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## RAILWAYS, HARBOURS, DOCKS AND TUNNELS

| **Course Code** | 16CV62 | **Credits** | 03 |
|---|---|---|---|
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 –0– 0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.

2. Understand various concepts of geometric elements, points and crossings, significance of maintenance of tracks.
3. Gain knowledge on Harbours, Ports, docks and necessary navigational aids.
4. Gain the insights of various components of Docks and Harbours.
5. Apply design features of tunnels and understand the various methods of tunnelling and tunnel accessories.

**Pre-requisites**:

**Detailed Syllabus**

**UNIT I**

**Railway Engineering**

Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Components of permanent way – Rails, Rail Joints, wear and welding of rails, Sleepers (Functions, Types, Sleeper Density and aging of sleepers) Ballast ( Functions, requirements, Types, Quantity), Coning of wheels, Creep of rails, Route alignment surveys, conventional and modern methods.

**08 Hours**

**Self-study Topic:** rail fixtures and fastenings

**UNIT II**

**Geometric Design of Track**

Gradient, Grade Compensation on curves, Speed of Trains, Super elevation, Curves.

**Points and Crossings**

Definition, Direction of turnout, parts of switch or point, types of Switch, Crossings, Component parts of crossing, types of crossing, requirements and characteristics of good crossing and types.

**08 Hours**

**UNIT III**

**Harbours**

Introduction, Classification, Site selection, layout with components. Natural Phenomenon affecting the design of harbours, Protection facilities: breakwaters classification (mound breakwater and wall break water characteristics)

**Ports**

Terms related to ports, requirements of good ports, Classification, Planning and Layout of ports

**08 Hours**

**UNIT IV**

Docks (Classification, advantages and disadvantages). Introduction to quay walls (Design Steps and types), wharves, piers, jetties, warehouses, Dredging, transit sheds (Construction Requirements, Design Criteria), Guiding Facilities (Necessity, Fixed and floating light stations, Light house, Signals (requirements and Types)

**08 Hours**

**UNIT V**

**Tunnels**

Advantages and disadvantages, size and shape of tunnels, Surveying, transferring centreline and gradient from surface to inside the tunnel working face, weisbach triangle- Examples, Tunnelling in rocks- methods, tunnelling methods in soils- needle beam, Linear plate, methods of tunnelling in hard rock, Mucking and methods, Tunnel lining (necessity, objects and materials), Tunnel Lighting, Shafts (advantages, size and location)

**08 Hours**

**Self -study Topic:** Tunnel Lining and Tunnel Lighting

**Text Books:**


1. S. C. Saxena and S. P. Arora, "Railway Engineering", Dhanpat Rai Publications Private Limited, New Delhi.
2. R. Srinivasan, "Harbour, Dock and Tunnel Engineering", Charaotar Publishing House Private Limited, Anand, Gujurat.
3. H. P. Oza and G. H. Oza, "Docks and Harbour Engineering", Charaotar Publishing House Private Limited, Anand, Gujurat.


**References:**


1. B. L. Gupta and Amit Gupta, "Roads, Railways, Bridges, Tunnels and Harbours Dock Engineering", Standards Publishers Distributors, New Delhi.
2. Satish Chandra and M. M. Agarwal, "Railway Engineering", Oxford University Press, Newyork.


**Course Outcome (COs)**

| At the end of the course students will be able to | | Bloom's Level |
|---|---|---|
| 1. | Suggest and estimate the material quantity required for laying a railway track | **L1 L2** |
| 2. | Evaluate the various geometric components of Railway Track. | **L3** |
| 3. | Explain briefly the points and crossings. | **L1 L2** |
| 4. | Explain the classification of Harbour and to explain briefly about the components of Docks and Harbour | **L1 L2** |
| 5. | Develop layout plan of Harbour. | **L3** |
| 6. | Briefly explain the tunnelling operations and methods of tunnelling. | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | **PO1** |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences | **PO2** |
| 3 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| Lecture and Board | Assignments and Open Book Assignment |
| NPTEL/ Edusat | Quizzes |
| Power Point Presentation | Internal Assessment Tests |
| Videos | Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self-study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## WATER SUPPLY ENGINEERING

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV63 | **Credits:** | 03 |
| **Course Type:** | PC | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3-0-0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 03 hours |

**Course Learning Objectives (CLOs):**

1. Explain the significance of the physical, chemical and bacteriological characteristics of drinking water.
2. Demonstrate various methods of sampling of water for the analysis in the laboratory.
3. Design the economical diameter of the rising main.
4. Estimate the population of the future by using present statistics.
5. Design the various water treatment units for given population.

**Pre-requisites:**

1. Environmental Studies

**Detailed Syllabus**

### UNIT I

**Introduction to sources**

List of Surface and subsurface sources – suitability with regard to quality and quantity. Water for various beneficial uses and quality requirement. Need for protected water supply.

**Demand of water**

Types of water demands- domestic demand in detail, institutional and commercial, public uses, fire demand. Per capita consumption –factors affecting per capita demand, population forecasting, different methods with merits & demerits- variations in demand of water. type of fire hydrants, Fire demand – estimation by Kuichling's formula, Freeman formula & national board of fire underwriters formula, peak factors, design periods & factors governing the design periods

**08 Hours**

**Self Learning Topic:** Surface and subsurface sources

### UNIT II

**Quality of water**

Objectives of water quality management. wholesomeness & palatability, water borne diseases. Water quality parameters – Physical, chemical and Microbiological. Sampling of water for examination. Drinking water standards BIS & WHO guidelines.Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. and toxic / trace organics.

**Collection and conveyance of water**

Intake structures – different types of intakes, factor of selection and location of intakes. Design of the economical diameter for the rising main.

**08 Hours**

**Self Learning Topic:** Examination of water sample in terms of pH, DO

**UNIT III**

**Water treatment**

Objectives – Treatment flow-chart. Aeration- Principles, types of Aerators.

**Sedimentation**

Theory, settling tanks, types, design, Coagulant aided sedimentation, jar test.

**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

**08 Hours**

**UNIT IV**

**Softening**

Definition, methods of removal of hardness by lime soda process and zeolite process RO & Membrane technique.

**Miscellaneous treatment**

Removal of color, odor, taste, use of copper sulphate

**08 Hours**

**UNIT V**

**Disinfection**

Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder.

**Distribution systems**

System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems. Pipe appurtenances

**08 Hours**

**Self Learning Topic:** Pipe appurtenances

**Text Books:**


1. S.K.Garg, **"Water Supply Engineering"**, Khanna Publishers, First Edition publication year 2010.
2. B .C .Punmia and Ashok Jain, **"Environmental Engineering- I"**, Laxmi Publications Ltd, New Delhi, reprint Edition August 2007.
3. G.M .Fair, J.C.Geyer and D.A Okun, **"Water and Wastewater Engineering Vol-II",** : John Willey Publishers, New York
4. Sincero, A.P., and Sincero, G.A., "**Environmental Engineering – A Design Approach"**–Prentice Hall of India Pvt. Ltd., New Delhi, 1999.
5. Sawyer and Mc Carthy **"Chemistry for Environment Engineering"** Publisher: McGraw-Hill Education (ISE Editions); International 2 Revised edition (1 July 1994).


**Reference Books:**


1. **Manual on Water supply and treatment** –CPHEEO, Ministry of Urban Development, New Delhi , May 1999.
2. Hammer, M.J, **"Water and Wastewater Technology"**–SI Version, 2nd Edition, John Wiley and Sons, 1986.

3. Karia, G.L., and Christian, R.A., **"Wastewater Treatment – Concepts and Design Approach"**, Prentice Hall of India Pvt. Ltd., New Delhi, 2006.
4. Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse" , 4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd, , 2003.
5. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., **"Environmental Engineering"–**Mc Graw Hill Book Co, 1986.
6. Raju, B.S.N., **"Water Supply and Wastewater Engineering",** Tata McGraw Hill Pvt. Ltd., New Delhi, 1995.
7. IS Standards : 2490-1974, 3360-1974, 3307-1974.
8. **Standard Methods for Examination of Water and Wastewater**, American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC, 1995.

**Course Outcomes (COs)**

| | **At the end of this course, students will be able to** | **Bloom's Level** |
|---|---|---|
| **1** | **Understand** the need for protected water supply, Types of water demand and design period | **L2** |
| **2** | **Understand** the functions of Intake structures, factor for selection and location of intakes. | **L2** |
| **3** | **Analyze** water quality | **L4** |
| **4** | **Outline** the Water treatment flow chart | **L2** |
| **5** | **Design** various water treatment units**.** | **L6** |
| **6** | **Evaluate** the Softening methods | **L5** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| **1** | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| **2** | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| **3** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| **4** | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability | **PO7** |
| **5** | Graduates shall learn to apply the principles of engineering and management in multidisciplinary environment | **PO11** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100.
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## DESIGN OF STEEL STRUCTURES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV64 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1. Introduction to the students regarding behavior and design of elements in steel structures using current design specifications (IS 800-2007 is the code of practice used in the course.)
2. To make the students apply their knowledge from statics, and structural analysis to gain further understanding in the relationship between analysis and design of steel structures
3. To make the students learn the design of steel structural elements of different forms, connections between the elements under different states of loading and to prepare structural steel drawings.

**Pre-requisites:**

Students should have undergone course in statics and structural analysis.

**Detailed Syllabus**

### UNIT I

**Introduction**

Advantages and disadvantages of steel structures load and load combinations design philosophies, structural forms.

**Plastic Analysis Concept**

Introduction to plastic hinge, plastic collapse mechanisms, plastic analysis of beams

**08 Hours**

### UNIT II

**Bolted Connections**

Advantages, Types, Modes of failure, Introduction to simple, semi rigid and rigid connections, Eccentric connections (Plane of connection- parallel and perpendicular to the plane of the loading) beam to beam, beam to column connection, problems on simple connections

**08 Hours**

### UNIT III

**Welded Connections**

Advantages and Disadvantages, Types of joints, weld symbols, design of simple joint, eccentric connections (Plane of connection- parallel and perpendicular to the plane of the loading), beam to beam, beam to column connections, problems on simple connections

**Design of Tension members**

Modes of failure, analysis and design of tension members-angles, Lug angles

**08 Hours**

**Self Learning Topics:** Lug angles

**UNIT IV**

**Design of Compression Members**

Failure modes, sections used for compression members, member classification, analysis and design of axially loaded members, Design of Column splices, Design of lacing and battening, Design of slab base and gusseted base

**08 Hours**

**Self Learning Topics:** Design of Column splices

**UNIT V**

**Design of Beams**

Beam types, Section classification, Design of laterally supported and unsupported beams.

**08 hours**

**Text books:**

3. Subramanian N, **'Design of steel structures'**. Oxford University press, 1st Edition, 2008, ISBN 978019567681

4. Bhavikatti S S, **'Design of Steel Structures'**, Interline Publications, 2009, ISBN 97893800261

5. Duggal. S. K, **'Limit State Design of Steel Structures',** Tata Mograw-Hill Education Private Ltd, 2010. ISBN 9780070700239:

**IS codes:**

1. **IS-800-2007,** General construction in steel-code of practice
2. **IS-875-1987,** Code of practice for design loads,
3. **SP6 (6)-1972**, ISI handbook for structural engineers-application of plastic theory in design of steel structures.
4. **SP6 (1) -1964**, handbook for structural engineers-Structural steel sections

**Course Outcomes (COs)**

| | **At the end of the course, students will be able to:** | **Bloom's Level** |
|---|---|---|
| 1. | Understand the Philosophies of limit state design and Plastic analysis. | **L2** |
| 2. | Design bolted connections and welded connections. | **L5** |
| 3. | Design Tension, compression members and bases. | **L5** |
| 4. | Design laterally supported and unsupported beams. | **L5** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts | **PO1** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 3 | Graduates shall possess effective oral and written communication skills | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

**OPEN ELECTIVES**
**NUMERICAL METHODS IN CIVIL ENGINEERING**

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV651 | **Credits:** | 03 |
| **Course Type:** | OE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3-0-0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Ability to implement the basic principles of numerical techniques in day to day application of Civil Engineering.

**Prerequisites:**

1. Strength of materials
2. Structural Analysis I
3. Engineering Mechanics

**Detailed Syllabus**

**UNIT I**

**Introduction**

Historical development of Numerical techniques, role in investigations, research and design in the field of civil engineering

Development of algorithm for following methods for solution of linear simultaneous equation:

1. Gaussian elimination method, b) Gauss-Jordan matrix inversion method, c) Gauss-Siedel method and d) Factorization method

**Application of solution of linear system of equations to civil engineering problems**

Construction planning, slope deflection method applied to beams, frames and truss analysis.

**08 Hours**

**UNIT II**

**Application of root finding to civil engineering problems**

Development of algorithm for a) Bisection method and b) Newton-Raphson method and its applications for solution of non linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering

**Application of numerical integration for solving simple beam problems**

Development of algorithm for a) Trapezoidal rule and b) Simpson's one third rule and its application for computation of area of BMD drawn for statically determinate beams.

**08 Hours**

**UNIT III**

New Marks method for computation of slopes and deflections in statically determinate beams

**08 Hours**

**UNIT IV**

Development of algorithm and application of solution of ordinary differential equation to civil engineering problems by: a) Euler's method b) Runge Kutta $4^{th}$ order method.

**08 Hours**

**UNIT V**

**Application of finite difference technique in structural mechanics:** i. Introduction, expression of derivatives by finite difference: backward differences, forward differences and central differences. ii. Application of finite difference method for analysis of a) statically determinate beams, b) statically indeterminate beams

**08 Hours**

**Reference Books:**


1. **Numerical Methods for Engineers**- Chapra S.C. & R.P.Canale : McGraw Hill, 1990.
2. **Numerical methods in Engineering Problem-** N.Krishna Raju, K.U.Muthu : MacMillan Indian Limited, 1990.
3. **Numerical methods for Engineers and Scientists**- Iqbal H.Khan, Q. Hassan : Galgotia, New Delhi, 1997.
4. **Numerical methods in Computer Programs in C++"** – Pallab Ghosh : Prentice Hall of India Private Limited, New Delhi, 2006.
5. **Numerical methods for engineers using MATLAB and C – I** Edition SCHILLING " Thomson Publications"

**Course Outcomes (COs)**

| | At the end of the course, students will be able to | Bloom's Level |
|---|---|---|
| 1 | **Identify** the application potential of numerical methods | **L3** |
| 2 | **Solve** Civil engineering problems using numerical methods | **L3 L5** |
| 3 | **Demonstrate** application of numerical methods to civil engineering problems | **L2** |
| 4 | **Apply** differential equations and integration to solve civil engineering problems | **L3 L6** |
| 5 | **Outline** and **Propose** the finite difference techniques | **L3** |
| 6 | **Apply** the concept of partial differential equations and **Solve** practical problems | **L2 L6** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts | **PO1** |
| 2 | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| 3 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 4 | Graduates shall possess effective oral and written communication skills | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

1. Lecture and Board
2. NPTEL/ Edusat
3. Power Point Presentation
4. Videos

1. Assignments and Open Book Assignments
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## OPTIMIZATION TECHNIQUES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV652 | **Credits** | 03 |
| **Course Type:** | OE | **CIE Marks** | 50 |
| **Hours/week: L – T – P** | 3– 0 – 0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. Describe the applications of Optimization and formulate optimization problems
2. Analyse problems related to single variable and multiple variable optimization including practical applications
3. Illustrate the basic concepts of linear programming and application to real life problems
4. Demonstrate the principles of non linear programming to one dimensional and two dimensional problems
5. Outline the various concepts of transportation problems to practical problems
6. Describe the concept of Geometric programming and assignment problem and apply to practical problem

**Pre-requisites:**

1. Engineering Mathematics

**Detailed Syllabus**

### UNIT I

**Introduction**

Introduction to optimization, engineering applications of optimization, Formulation of structural optimization problems as programming problems. Single variable optimization, multivariable optimization with no constraints, Multivariable optimization with equality constraints - Solution by direct substitution, Solution by the method of Constrained Variation and Solution by the Method of Lagrange Multipliers

**08 Hours**

### UNIT II

**Linear Programming**

Introduction, Applications of Linear programming, standard form of linear programming, Graphical solution, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, duality in linear programming

**08 Hours**

### UNIT III

**Non-linear programming**

Introduction, One dimensional minimization methods: Elimination methods – Unrestricted Search, Internal Halving Method, Fibonacci method, Golden section method.

Introduction to Unconstrained optimization techniques. Univariate method, Powell’s Method, Indirect Search (Descent) Methods- Steepest Descent(Cauchy) Method, Fletcher-Reeves Method and Newton’s Method.

**08 Hours**

### UNIT IV

**Transportation Problem**

Introduction, mathematical formulation, optimal solution of transportation problem methods for initial basic feasible solution, summary of methods of initial BFS, Northwest corner method, Lowest cost entry method, Vogel's approximation method, optimality test, Degeneracy in Transportation problems, unbalanced transportation problem.

**08 Hours**

## UNIT V

**Geometric programming and Assignment problem**

Introduction and solution of uncontrained Geometric programming problems

Introduction to Assignment problem. Structure of assignment problem. Formulation and solution of assignment problem, Traveling salesman problem as an assignment problem

**08 Hours**

**Text Books:**

1. S.S. Rao, "**Optimization – Theory and Practice**"- Wiley Eastern Ltd.
2. Bhavikatti S.S. - "**Structural optimization using sequential linear programming**"- Vikas publishing house.

**Reference Books:**

1. Spunt, "**Optimum Structural Design**"- Prentice Hall
2. Uri Krisch, "**Optimum Structural Design**"- McGraw Hill
3. Richard Bronson, "**Operation Research**"- Schaum's Outline Series

**Course Outcome (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | **Apply** the principles of optimization and **Formulate** optimization problems | **L3 L6** |
| 2 | **Outline** the principles of single variable and multivariable optimization and **Solve** practical problems | **L2 L3** |
| 3 | **Explain** the concepts of linear programming and **Formulate** LPP for real life problems | **L2 L6** |
| 4 | **Explain** the concepts of non linear programming and **Formulate** NLP for real life problems | **L2 L6** |
| 5 | **Summarize** the concepts of various transportation problems turbines and centrifugal pump | **L2** |
| 6 | **Explain** the concept of Geometric programming and Assignment problem and **Apply** to practical problems | **L2 L3** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2 | Graduates shall possess the ability to review the research literature, design, conduct experiments and to analyze, interpret experimental results | **PO2** |
| 3 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues | **PO3** |
| 4 | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| 5 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 6 | Graduates shall possess effective oral and written communication skills | **PO7** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |

| | |
|---|---|
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| ➢ Two IA tests are compulsory.<br>➢ Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50. | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer
4. FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## ENVIRONMENTAL IMPACT ASSESSMENT

| | | | |
|---|---|---|---|
| **Course Code** | 16CV653 | **Credits** | 03 |
| **Course type** | OE | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives (CLOs)**

1. Describe EIA and EIS.
2. Discuss the role of MOEF in EIA studies.
3. Explain step-by-step for conducting EIA.
4. Understand the various environmental attributes.
5. Discuss the environmental impact for a nuclear power plant project.

**Pre-requisites: Environmental Studies**

**Detailed Syllabus**

### UNIT I

**Introduction**

Development Activity and Ecological Factors EIA, Rapid and Comprehensive EIA, EIS, FONSI. Need for EIA Studies, Baseline Information. Step-by-step procedures for conducting EIA, Limitations of EIA

**08 Hours**

**Self Learning Topics:** Limitations of EIA.

## UNIT II

**Contents of EIA**

Frame work of Impact Assessment. Development Projects-Environmental Setting, Objectives and Scope, Methodologies, Techniques of EIA. Salient Features of the Project Activity-Environmental Parameter Activity Relationships- Matrices

**08 Hours**

## UNIT III

**Assessment and Prediction**

Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment

**08 Hours**

## UNIT IV

**EIA guidelines**

Guidelines for Development Projects, Rapid and Comprehensive EIA.

Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements

**08 Hours**

**Self Learning Topics:** Various Participants

## UNIT V

**EIA for developmental projects**: EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

**08 Hours**

**Text books**

13 Jain R.K., "**Environmental Impact Analysis"**, McGraw-Hill, New Delhi, Second Edition, 2002.

14 Anjaneyalu. Y, Vali. Manickam, "**Environment Impact Assessment Methodologies"**, B.S. Publications, 2nd Edition, 2007.

**References**

6. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
7. Larry W. Canter**, "Environment Impact Assessment",** McGraw-Hill Education, second edition, 1996.

**Course Outcome (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | Differentiate between EIA and EIS. | **L4** |
| 2 | Write the role of MOEF, NEPA in EIA studies. | **L3** |
| 3 | Explain step-by-step for conducting EIA. | **L2** |
| 4 | Define attributes and List the various environmental attributes. | **L1** |
| 5 | Quantify the environmental impact for a nuclear power plant project | **L5** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall possess the ability to review the research literature and analyse complex engineering problems. | **PO2** |
| 2 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO3** |

| | | |
|---|---|---|
| 3 | Graduates shall be able to understand contemporary societal issues to address them professionally | **PO6** |
| 4 | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability. | **PO7** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| Two IA tests are compulsory.<br>Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50. | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## REMOTE SENSING AND GIS

| | | | |
|---|---|---|---|
| **Course Code** | 16CV654 | **Credits** | 03 |
| **Course type** | OE | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1. Explain the fundamentals of Remote sensing concepts.
2. Illustrate the types of Remote sensing platforms and sensors.
3. Summarize the different steps and computation involved in Aerial Photogrammetry.
4. Explain the fundamentals of Geographical Information System.

5. Elaborate the concept of coordinate systems and outline the applications of Remote sensing and GIS.

**Pre-requisites:**

1. Basic Surveying
2. Advanced Surveying

**Detailed Syllabus**

**UNIT I**

**Remote sensing**

Introduction, Ideal remote sensing system, basic principles of electromagnetic remote sensing, electromagnetic energy, electromagnetic spectrum, interaction with earth's atmosphere, interaction with earth- surface materials, spectral reflectance of earth surface materials

**08 Hours**

**UNIT II**

**Remote sensing platforms and sensors**

Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal), Global Positioning system-GPS satellite systems, components of GPS, positioning and relative positioning with GPS, Applications of GPS. Introduction to DGPS and its uses.

**08 Hours**

**UNIT III**

**Aerial Photogrammetry**

Introduction, basic geometric characteristics of aerial photographs, photographic scale, ground coverage of aerial photographs, Area measurement, relief displacement of vertical features, image parallax, ground control for aerial photography, mapping with aerial photographs, flight planning, Basics of stereoscopy, stereoscopes.

**08 Hours**

**Self Learning Topics**: Basics of stereoscopy, stereoscopes

**UNIT IV**

**Fundamentals of Geographical Information System**

Definition of GIS, History of GIS, Key Components of GIS, Data structures in GIS, Geospatial data, GIS operations, Data overlay, Data input and editing, Data display and Cartography.

**08 Hours**

**UNIT V**

**Coordinate systems**

Geographical Coordinate System, Datum, Map projections, Types of Map Projections, Projected Coordinate System.

**Applications**

Integration of Remote Sensing and GIS, Applications of Remote sensing and GIS, Softwares scenario in Remote sensing and GIS.

**08 Hours**

**Text books:**

1. Lillesand T.M., and R.W. Kiefer, "Remote sensing and image interpretation." John Wiley & Sons, Fourth edition , 2000.
2. Kang tsuang Chang "Introduction to Geographical Information Systems"– Tata McGraw Hill, New Delhi, Fourth edition, Twelfth edition reprint, 2013.

3. M. Anji Reddy, "Remote Sensing and Geographical Information systems", BS Publications, Fourth edition, Twelfth edition reprint, 2017

**Reference books**:

1. A. M. Chandra and S. K. Gosh. "Remote Sensing and GIS", Narosa Publishing Home, New Delhi 2009.
2. James B. Campbell and Randolph H. Wynne, "Introduction to Remote Sensing", The Guilford Press, 2011
3. Paul Longley, "Geographic Information systems and Science", John Wiley & Sons, 2005.

**Course Outcomes (COs)**

| | At the end of the course, students will be able to | Bloom's Level |
|---|---|---|
| 1 | **Understand** the fundamentals of Remote sensing concepts | **L2** |
| 2 | **Select** and **utilize** the data available from different type of remote sensing satellites for required purpose | **L1 L3** |
| 3 | **Interpret** aerial photographs and **Determine** the field dimensions | **L2 L4** |
| 4 | **Analyze** the basic components of GIS | **L4** |
| 5 | **Understand** the concept of Map projections and **apply** the techniques of remote sensing and GIS to required field. | **L2 L3** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2 | Graduates shall learn to apply the principals of engineering and management in multidisciplinary environment. | **PO11** |
| 3 | Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth. | **PO12** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50.

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1 SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.

2. Minimum marks required in SEE to pass: 40 out of 100

3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

**EXTENSIVE SURVEY PROJECT**

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CVL66 | **Credits:** | 03 |
| **Course Type:** | PC | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 1 – 0 – 4 | **SEE Marks:** | 50 |
| **Total Hours:** | 20+20 | **SEE Duration:** | 3 Hours |

**Course learning objectives (CLOs)**

1 Comprehend the steps and computations involved in surveying.

2 Outline the concepts of dynamics of water flow

3 To define and determine the index properties of soil.

4 Design various wastewater treatment units for given population.

5 To gain the knowledge of data collection, sampling, analysis of data of various surveys of traffic engineering.

**Pre-requisites:**

1. Surveying
2. Hydraulics and Hydraulics Machines
3. Hydrology & Irrigation Engineering
4. Environmental Engineering (Water supply and Sanitary engineering)
5. Soil Mechanics
6. Transportation Engineering

**Detailed Syllabus**:

(To be conducted between $5^{th}$ & $6^{th}$ Semester for a period of 1 week, Viva voce conducted along with $6^{th}$ semester exams)

An extensive survey training involving investigation and design of the following projects is to be conducted for 1 week (08 days). The student shall submit a project report consisting of designs and drawings. **(Drawings should be done using AutoCAD)**

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

2. **New tank projects**

The work shall consist of

3. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
4. Capacity surveys.
5. Details at Waste weir and sluice points.
6. Canal alignment.

**(At least one of the above new tank projects should be done by using TOTAL STATION)**

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**.**

6. **Old tank projects**

The work shall consist of

a. Alignment of center line of the existing bund, Longitudinal and cross sections of the centre line.
b. Capacity surveys to explore the quantity.
c. Details at existing Waste weir and sluice points.

**Course Outcomes (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | Apply Surveying knowledge and tools effectively for the projects | **L3** |
| 2 | Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioural competencies. | **L2** |
| 3. | Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills | **L3** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall be able to understand and apply the basic mathematical and scientific concepts | **PO1** |
| 2. | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 3 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO3** |

**Scheme of Continuous Internal Evaluation (CIE)**

| Field work | Preparation of report | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

# **Minimum CIE marks required for eligibility for SEE: 13 out of 25**
# **Submission of Report and certification is compulsory for eligible to SEE**
# **Scheme of Semester End Examination (SEE):**

Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.

Individual viva voce shall be taken.

Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Presentation of project work | 20 marks |
| Viva voce | 20 marks |

## RCC DESIGN AND DRAWING LABORATORY

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CVL67 | **Credits:** | 03 |
| **Course Type:** | PC | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 1 – 0 – 4 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 4 Hours |

**Course learning objectives (CLOs)**

1. Use of the notations and abbreviations as per SP-34 in drawing and detailing of RC structures.
2. Apply the design concepts to draw and detail the RC structural elements such as beams, slabs, stairs and column/ footing.
3. Analyze and design the rectangular combined footings, retaining walls, portal frame
4. Illustrate the reinforcement details for portal frames, footings, columns, beams, slabs and retaining walls.

**Pre-requisites:**

1. Building planning and drawing
2. Design of RC structural elements

**PART - A**

4. Layout Drawing: General layout of building showing, position of columns, footings, beams and slabs with standard notations.
5. Detailing of Beam and Slab floor system, continuous beams.
6. Detailing of Staircases: Dog legged and Open well.
7. Detailing of Column footings: Column and footing (Square and Rectangle)

**10 (T) + 10 (D)**

**PART - B**

8. Design and detailing of Rectangular Combined footing slab type and slab and beam type.
9. Design and detailing of Cantilever Retaining wall.
10. Design and detailing of Simple Portal Frames subjected to gravity loads. (Single bay & Single storey)
11. Design and detailing of elevated water tank.

**10 (T) + 10 (D)**

**Text Books:**


1. N. Krishnaraju," **Structural Design & Drawing Reinforced Concrete & Steel**-, University Press.
2. Krishnamurthy "**Structural Design and Drawing**-", (Concrete Structures), CBS publishers, New Delhi. Tata Mc-Graw publishers.
3. S.S. Bhavikatti, " Advanced R.C.C Design" (RCC-Vol-2), New Age International Publisher, New, Delhi


**Reference books**:


1. IS 456 – 2000 "**Indian Standard Plain and Reinforced Concrete Code of Practice**" (Fourth Revision) BIS New Delhi
2. SP-34: 1987 – **"Handbook on concrete reinforcement and detailing**"-BIS New Delhi
3. SP-16:1980 **" Design aids for reinforced concrete to IS: 456-2000"** BIS New Delhi


**Course Outcomes (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | Apply/Use the notations and abbreviations for different building elements such as beams, columns, footings etc. | **L3** |

| | | |
|---|---|---|
| 2 | Design the rectangular combined footings, retaining walls, portal frame water tank | **L6** |
| 3 | Compile and draw the reinforcement details for portal frames, footings, columns, beams, slabs, retaining walls and water tank. | **L6** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 3 | Graduates shall possess effective oral and written communication skills | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |
| 2. NPTEL/ Edusat | 2. Internal Assessment Tests |
| 3. Power Point Presentation | 3. Semester End Examination |
| 4. Videos | |

**Scheme of Continuous Internal Evaluation (CIE):**

The Total marks of CIE shall be 50. Drawing submission for 30 marks, one test for 10 marks, and 10 marks for class participation

| Components | Submission (Continuous evaluation) | Performance in tests | Class participation |
|---|---|---|---|
| Maximum Marks 50 | 30 | 10 | 10 |
| ➢ Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50. | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Semester end examination of four hour duration. Three questions each carrying 20 marks are to be set from part-A and two questions each carrying 60 marks are to be set from part-B. Student has to answer two questions from part-A and one question from part-B.

## HYDRAULIC STRUCTURES DESIGN AND DRAWING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL68 | **Credits** | 03 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 1-0-4 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 4 Hours for 100 marks |

**Course Learning Objectives**

1. Acquaint students with the basic design principle of Hydraulic structures and appurtenant works.
2. Classify reservoirs and should be able to fix its capacity and safe yield**.**

3. Outline the concept of reservoir sedimentation and be able to work out the life of a reservoir.
4. Describe the concept of theoretical profile and obtain the practical profile of a gravity dam.
5. Understand the concept of failure of dams and to analyze and design gravity dam and overflow section..
6. Design and draw plan, sectional elevation and cross-section of various real life hydraulic structures.

**Pre-requisites:**

1. Hydrology and Irrigation Engineering

**Detailed Syllabus**

**PART A**

**Reservoir Planning**

Introduction, classification of Reservoirs, Storage zones of a reservoir, Mass curve, fixing capacity of a reservoir, safe yield, problems, density currents, Trap efficiency, Reservoir sedimentation, life of a reservoir, economic height of a dam, problems

**Gravity Dams**

Introduction, forces on a gravity dam, stress analysis in gravity dam, Problems, combination of forces for design. Elementary & practical profiles of a gravity dam, stability analysis (without earth quake forces), problems, galleries in gravity dams

**Spillways**

Introduction, types of spillways, design formula for Ogee spillway, Variation of coefficient of discharge with various factors, design of spillways

**15 hours**

**PART-B**

**Irrigation Design-Drawing**

Design and Drawing with all the three views of:

1. Surplus weir with stepped apron
2. Tank sluice without tower head
3. Direct Sluice
4. Notch type Canal Drop
5. Canal Regulator

**25 hours**

**Text Books**


1. Text book of irrigation engineering & Hydraulic Structures- R.K.Sharma, Oxford &IBH publishing Co., New Delhi (2002)
2. Irrigation & Water resources Engineering- G.L.Asawa, New Age International Publishers, New Delhi ( 2005)
3. Irrigation, Water Resources & Water power Engineering- Modi. P.N., Standard Book House, New Delhi
4. Design of minor irrigation and Canal structures- C. SathyaNarayana Murthy, Wiley eastern limited, New Delhi (1990)


**Reference Books**


1. Irrigation engineering & Hydraulic structures- Garg.S.K., Khanna publishers, New Delhi.
2. Hydraulic Structures & Irrigation Design Drawing - Dr.N.Balasubramanya, Tata Mcgraw-Hill Education Pvt. Ltd., New Delhi.
3. Irrigation and Water Power Engineering- Madan Mohan Das &Mimi Das Saikia, PHI Learning Pvt. Ltd., New Delhi (2009)

**Course Outcome (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1 | **Apply** the basic design principles for hydraulic structures and appurtenant works | **L3** |
| 2 | **Explain** the various forces and its combination for gravity dams | **L2** |
| 3 | **Explain** the modes of failure of various types of dams and formulate the design criteria | **L2 L6** |
| 4 | **Design** and **Interpret** field data in case of actual field problems related hydraulic structures | **L6** |
| 5 | **Demonstrate** his/her skills to prepare models of real life hydraulic structures like spillways, dams, weirs, regulators, drops, sluices etc. | **L6** |

**Program Outcome of this course (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| 2. | Graduates shall possess the ability to review the research literature and analyse complex engineering problems. | **PO2** |
| 3. | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO3** |
| 4. | Graduates shall be able to design and conduct experiments and interpret the results as per the current research. | **PO4** |
| 5. | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures.**[** | **PO5** |
| 6. | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability. | **PO7** |
| 7. | Graduates shall learn to apply the principles of engineering and management in multidisciplinary environment. | **PO11** |

**Course delivery methods**

1. Lecture and Board
3. Videos
4. NPTEL / Edusat

**Assessment methods**

1. Assignments
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination (SEE)

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

| Scheme of Semester End Examination (SEE): | |
|---|---|
| 1. | It will be conducted for 100 marks of 4 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2 | **Question paper pattern:**<br>**Two** questions are to be set from Part A of which **One** will be compulsory question. Total marks for Part A is for 40 marks<br>**Two** questions are to be set from Part B of which **one** full question is to be answered for 60 marks ( 20 marks for design + 40 marks for three views ) |

**CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND HUMAN VALUES**

| **Course Code** | 16CV69 | **Credits** | 02 |
|---|---|---|---|
| **Course type** | HS | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 2-0-0 | **SEE Marks** | 25 |
| **Total Hours:** | 30 | **SEE Duration** | 2 Hours |

**Course Learning Objectives**

1. To provide basic information about Indian Constitution.
2. To identify individual role and ethical responsibility towards society

**Pre-requisites: NIL**

**Detailed Syllabus**

**UNIT I**

**Constitution of India**

**Chapter 1:** Introduction to Constitution of India- Formation and Composition of the Constituent Assembly –Salient features of the Constitution- Preamble to the Indian Constitution-Fundamental Rights- Fundamental Duties - Directive principles of state policy.

**Chapter 2:** Parliamentary system of governance-Structure of Parliament- Loksabha and Rajyasabha- Functions of Parliament- Legislative, Executive, Financial functions, Powers of Loksabha and Rajyasabha- Procedure followed in parliament in making law- Lokpal and functionaries.

Structure of union executive- Power and position of President, Vice President, Prime Minister and council of Ministers. Structure of Judiciary- Jurisdiction and functions of Supreme Court, High Court and subordinate courts.

**Chapter 3:** Federalism in Indian Constitution, Division of Powers- Union List, State List and Concurrent List, Structure of State legislation, Legislative Assembly and Legislative Council, Functions of State legislature, Structure of State Executive- Powers and positions of Governor, peaker, Deputy Speaker, Chief Minister and Council of Ministers.

Local self government- meaning- Three tier system- Village Panchayat- Taluka Panchayat-Zilla Panchayat- Local Bodies- Muncipalities and Corporations, Bruhath Mahanagara Palike. Functions of Election Commission, UPSC, KPSC.

**12 Hours**

## UNIT II

**Human Values**

**Chapter 4:** Objectives, Morals , Values, Ethics, Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage ,Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place, Spirituality.

**08 Hours**

## UNIT III

**Professional Ethics**

**Chapter 5:** Engineering Ethics: Overview, senses of engineering ethics, variety of moral issues, types of enquiries, moral dilemma, moral autonomy, moral development (theories), consensus and controversy, profession, models of professional roles, responsibility,

**Chapter 6:** Theories about right action (ethical theories), self-control, self-interest, customs, religion, self-respect, case studies (Choice of the Theory), engineering as experimentation, engineers as responsible experimenters.

**Chapter 7:** Codes of ethics, Environmental ethics, Computer ethics, Engineers as managers, Ethics and code of business conduct in MNC.

**10 Hours**

**Books**


1. Durga Das Basu, **"Introducing to the Constitution on India",** (Students Edition.) Prentice – Hall EEE, 19th / 20th Edition., 2001
2. Raman B.S. and Yagi R.K., **"Constitutional Law and Professional Ethics,"** United Publishers, 2005
3. Rajaram M., **"Constitution of India and Professional Ethics,"** New Age International Publishers, 3rd Edition
4. Nagarazan R.S., **"Professional Ethics and Human Values,"** New Age International Publishers Pvt. Ltd. 2006


**Course Outcome (COs)**

| | At the end of the course, the student will be able to: | Bloom's Level |
|---|---|---|
| 1. | Know and explain state and central policies, fundamental duties. | L1 L2 |
| 2. | Know and explain the functioning of the democracy in the country | L1 L2 |
| 3. | Appreciate and practice the ethical issues | L3 |
| 4. | Know and apply the code of ethics practiced in the professional bodies. | L1 L3 |

**Program Outcome of this course (POs)**

| | | |
|---|---|---|
| 1. | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. | PO6 |
| 2. | Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. | PO8 |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

| | Course delivery methods | | Assessment methods |
|---|---|---|---|
| 1 | Lecture | 1. | I. A. test |
| 2 | Presentation | 2. | SEE |

3 Expert talks

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 25 | 15 | ---- | ---- | 10 | 25 |

- Writing two IA tests is compulsory.
- Descriptive type questions.
- One unit each for each IA test.
- **Minimum marks required to qualify for SEE:** 10 marks out of 25

**Scheme of Semester End Examination (SEE):**

1. SEE question paper for 50 marks having descriptive type questions will be conducted for two hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.
2. Choice in each unit.

## SEMESTER VII

## GEOTECHNICAL ENGINEERING

| | | | |
|---|---|---|---|
| **Course Code** | 16CV71 | **Credits** | 04 |
| **Course type** | PC | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-1-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLO's)**

1. To **define** the basic operations of sub soil exploration and methods.
2. To **analyze** stresses in soil by various methods
3. To **differentiate** the concepts such as Active passive and earth pressure at rest and related problems
4. To **evaluate** the stability of slopes and stability number.
5. To **formulate** the bearing capacity equations for different field problems involving soil and water and estimation of settlement of soil

**Pre-requisites:**

1. Strength of Materials
2. Soil Mechanics

### UNIT I

**Subsurface exploration**

Importance of exploration program, Methods of exploration: Boring, sounding, and geophysical exploration, Types of samples and samplers, evaluation of sample disturbance, area ratio, recovery ratio, inside and outside clearances, Typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report

**Drainage and dewatering**

Determination of ground water level by Hvorselev'smethod, Control of ground water during excavation: Dewatering - Ditches and sumps, well point system, Vacuum method, Electro-Osmosis method.

**08 Hours**

### UNIT II

**Stresses in soils**

Boussinesq's and Westergaard's theories for concentrated, circular and strip. Pressure distribution diagrams on horizontal and vertical planes, isobars and pressure bulb, Newmark's chart- construction and uses

**08 Hours**

**Self Learning Topics:** Difference between Boussinesq's and Westergaard's theories

### UNIT III

**Lateral earth pressure**

Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories–assumptions and limitations, Graphical solutions for active earth pressure (cohesionless soil only) – Culmann's and Rebhann's methods, Lateral earth pressure in C- φ soils, Earth pressure distribution diagrams

**08 Hours**

### UNIT IV

**Stability of earth slopes**

Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of infinite slopes, Stability of finite slopes by Method of slices and Friction Circle method, Taylor's stability number, Fellineous method **08 Hours**

## UNIT V

**Bearing capacity and settlement**

Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's bearing capacity equations - assumptions and limitations, Effect of ground water table on bearing capacity. Field methods of evaluation of bearing capacity using plate load test, standard penetration test and cone penetration test.

Importance and Concept of Settlement Analysis, Immediate, Consolidation and settlements (no derivations, but, computation using relevant formula for Normally Consolidated soils), BIS specifications for total and differential settlements of footings and rafts

**08 Hours**

**Self Study:** Brinch Hansen's Bearing capacity equations

**Text books**


1. Punmia B.C. (2005) "**Soil Mechanics and Foundation Engg**" 16th Edition Laxmi Publications Co., New Delhi.
2. Murthy V.N.S. (1996), "**Principles of Soil Mechanics and Foundation Engineering"** 4th Edition, UBS Publishers and Distributors, New Delhi.
3. GopalRanjan and Rao A.S.R. (2000), "**Basic and Applied Soil Mechanics"** New Age International (P) Ltd., New Delhi.
4. Venkatrahmaiah C. (2000), "**Geotechnical Engineering"**, Universities Press, Hyderabad.


**References books**


1. Braja, M. Das (2002), "**Geotechnical Engineering"** Fifth Edition, Thomson Business Information India (P) Ltd., India
2. Alam Singh and Chowdhary G.R. (1994), "**Soil Engineering in Theory and Practice"** CBS Publishers and Distributors Ltd., New Delhi.
3. Bowles J. E. (1996), "**Foundation Analysis and Design"** Bowles J.E., 5th Edition, McGraw Hill Pub. Co. New York
4. Donold P Coduto Phi, "**Geotechnical Engineering**" Learning Private Limited, New Delhi
5. Shashi K. Gulathi & Manoj Datta. (2009), "**Geotechnical Engineering**" Tata McGraw Hill.


**Course Outcome (COs)**

| | At the end of the course, students will be able to | Bloom's Level |
|---|---|---|
| 1 | **Explain** methods of soil exploration | **L5** |
| 2 | **Analyze** stresses in soil by various methods | **L4** |
| 3 | **Evaluate** lateral earth pressure by various methods | **L5** |
| 4 | **Estimate** the stability of slopes | **L5** |
| 5 | **Estimate** bearing capacity and settlement of soil | **L6** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 3 | Graduates shall possess effective oral and written communication skills | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignments |

| | |
|---|---|
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |
| ➢ Two IA tests are compulsory.<br>➢ Minimum marks required to qualify for SEE: Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out of 50. | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## QUANTITY SURVEYING AND VALUATION

| | | | |
|---|---|---|---|
| Course Code | 16CV72 | Credits | 04 |
| Course type | PC | CIE Marks | 50 |
| Hours/week: L-T-P | 3-1-0 | SEE Marks | 50 |
| Total Hours: | 40 | SEE Duration | 3 Hours for 100 marks |

**Course Learning Objectives**

1. Understand and differentiate the various types of estimation.
2. Understand the importance of specification in the estimation.
3. Understand quantity estimate for particular item of works of a building.
4. Understand abstract estimate for various building.
5. Understand various material rates and rate analysis.
6. Brief idea about tender, contracts, valuation of construction activity

**Pre-requisites:** Building Materials and Construction Technology, Building Planning and Computer Aided Drawing

### UNIT I

**Estimate and specifications**

Different type of estimates, approximate methods of estimating buildings, cost of materials. Definition of specifications, objective of writing specifications, essentials in specifications, general and detail

specifications of common item of works in buildings. Study of various drawings with estimates, important terms, units of measurement

**Self Learning Topics:** Collection and study of present market rates and SR rates.

**08 Hours**

**UNIT II**

**Estimation for building**

Abstract Methods of taking out quantities and cost -center line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – RCC framed structures with flat, with all Building components. Load bearing structure and framed structure

**08 Hours**

**UNIT III**

**Estimation for other structures**

Steel truss (simple truss), Manhole and septic tanks, RCC Culverts (only return wing wall)

**08 Hours**

**UNIT 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, centering and form work for different RCC items, wood and teak works for doors, windows and ventilators

**08 Hours**

**UNIT V**

**Estimation for roads, contracts and valuation**

Estimation of WBM roads, Asphalt roads, concrete roads

CONTRACTS: Types of contract – essentials of contract agreement – legal aspects. Definition of the terms – Tender, earnest money deposit, security deposit, Administrative approval – Technical sanction. Nominal muster roll, measurement books VALUATION- Definitions of various terms, method of valuation, Sinking fund, depreciation and method of estimating depreciation, Outgoings.

**08 Hours**

**Self Learning Topics:** Prepare a Tender document for new construction building project. Prepare a valuation report for old building.

**Text books**


1. **Estimating & Costing**, B. N. Dutta, Chand Publisher
2. **Quantity Surveying**- P.L. Basin S. Chand, New Delhi.
3. **Estimating & Specification** - S.C. Rangwala, Charotar publishing house, Anand.
4. **Text book of Estimating & Costing**- G.S. Birde, Dhanpath Rai and sons, New Delhi.
5. **A text book on Estimating, Costing and Accounts**- D.D. Kohli and R.C. Kohli S. Chand: New Delhi.
6. **Contracts and Estimates,** B. S. Patil, University Press, 2006.


**Course Outcome (COs)**

| | At the end of the course, the student will be able to | **Bloom' Level** |
|---|---|---|
| 1 | **Understand** important of estimation in civil construction works | **L2** |
| 2 | **Estimate** the quantity as per the given drawings and specification | **L5** |
| 3 | **Analyze** the current rates for various items of works as per the market rates | **L4** |
| 4 | **Understand** Importance of contract, tender, valuation documents with construction clauses | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| **1** | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| **2** | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues | **PO3** |
| **3** | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| **4** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| **5** | Graduates shall be able to understand contemporary societal issues to address them professionally | **PO6** |
| **6** | Graduates shall possess effective oral and written communication skills | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

**Course delivery methods**

1. Lecture and Board
3. Videos
4. NPTEL / Edusat

**Assessment methods**

1. Assignments
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination (SEE)

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Question paper pattern:**

   **Three** questions are to be set from Part A of which **Two** full questions are to be answered for 40 marks

   **Two** questions are to be set from Part B of which **one** full question is to be answered for 60 marks ( 20 marks for design + 40 marks for three views )

**WASTEWATER ENGINEERING**

| | | | |
|---|---|---|---|
| **Subject Code** | 16CV73 | **Credits** | 04 |
| **Course Type** | PC | **CIE Marks** | 50 |
| **Hours/week: L – T – P** | 3–1– 0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLO)**

1. Understand and explain the basics of sewage, its composition and characteristics.
2. Explain the significance of sanitation
3. Demonstrate various methods of sampling of sewage.

4. Explain different methods for sewage treatment.
5. Design various wastewater treatment units for given population.

**Pre-Requisites**

1. Environmental Studies
2. Water Supply Engineering

**UNIT I**

**Quantity of Sewage**

Necessity and objectives of sanitation, methods of domestic wastewater disposal, Estimation of storm runoff - dry weather flow (DWF) and wet weather flow (WWF), factors affecting DWF and WWF, flow variations and their effects on design of sewerage system; computation of design flow, estimation of storm flow. Time of Concentration

**Collection and Conveyance**

Hydraulic design of sewers, self cleansing and non-scouring velocities, design principles for circular sewers – flowing full and partially full conditions, Sewer sections, materials, sewer appurtenances, laying of sewers and testing of sewers.

**08 Hours**

**Self Learning Topics:** Sewer appurtenances.

**UNIT II**

**Quality of Sewage**

Sampling and characteristics of sewage: physical and chemical analysis and their significance. Concept of BOD, DO, Population equivalent

**Pollution**

Point and Non Point Sources of Pollution, Eutrophication

**Self-Purification**

Self-purification phenomenon, oxygen sag curve, Effluent disposal standards for various methods, sewage farming and numerical problems on disposal of effluents

**08 Hours**

**UNIT III**

**Preliminary and Primary Treatment of Sewage**

Flow diagrams for wastewater treatment, Preliminary and primary treatment units – theory and operation of screens, Grit chamber, settling tanks, design of settling tanks (Design of Grit chamber and settling tanks)

**Biological Treatment of Sewage**

Aerobic and Anaerobic treatment methods of wastewater treatment attached growth process and suspended growth process. Batch reactors, Continuous flow reactors and plug flow reactors.

**08 Hours**

**UNIT IV**

**Attached Growth Process**

Construction, working and design principles of Trickling filters (Problems on single stage only), Construction and working of Rotating Biological Contactors

**Suspended Growth Process**

Construction, working and design principles of Activated sludge process (ASP), Various modifications in ASP, Design of completely mixed type ASP.

**Sludge Management**

Sludge thickening - sludge digestion, drying beds, sludge disposal methods (Excluding problems).

**08 Hours**

## UNIT V

**Conventional Treatment**

Oxidation ponds, stabilization ponds, septic tanks and effluent disposal system (excluding problems)

**Advanced Treatment**

Sequential Batch Reactor (SBR), Up-flow Anaerobic Sludge Blankets (UASB), Concept of Membrane Technique, Concept of sanitation in townships, Recycle and reuse of waste effluents (excluding problems).

**08 Hours**

**Text Books**


1. Garg S.K.**, "Environmental Engineering - Vol II",** Khanna Publishers, 33rd Edition, 2015
2. Punmia B. C. and Jain Ashok, **"Waste Water Engineering",** (2007), Laxmi Publication Ltd, New Delhi, reprint Edition August 2007 onwards
3. George Tchobanoglous, Howard S. Peavy, Donald R. Rowe, **" Environmental Engineering"** , Tata McGraw Hill Publishing Co Ltd. 1st Edition 2013


**Reference**


1. Fair G.M, Geyer J.C and Okun D.A, **"Water and Wastewater Engineering",** Vol-II, John Wiley Publishers, New York.
2. Hammer M.J, **"Water and Wastewater Technology",** SI version, 2nd Edition, John Wiley and Sons, 1986.
3. **"Manual on wastewater and treatment",** CPHEEO, Ministry of Urban Development, New Delhi, May 1999.


**Course Outcome (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | **Understand** the basics of sewage, its composition and characteristics. | **L2** |
| 2. | **Explain** the significance of sanitation and demonstrate various methods of sewage sampling. | **L2** |
| 3. | **Explain** different methods of sewage treatment. | **L3** |
| 4. | **Design** various wastewater treatment units. | **L6** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall possess the ability to review the research literature and analyze complex engineering problems | **PO2** |
| 2 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues | **PO3** |
| 3 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| 4 | Graduates shall be able to understand contemporary societal issues to address them professionally. | **PO6** |
| 5 | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability | **PO7** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |

3. Power Point Presentation
4. Videos

3. Internal Assessment Tests
4. Semester End Examination

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## ELECTIVES III
## MATRIX METHODS OF STRUCTURAL ANALYSIS

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV741 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3-0-0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 Marks |

**Course Learning Objectives (CLOs)**

After the successful completion of this course, the student shall be able to:

1. Study the fundamentals of Matrix methods and Understand the concept of system approach of flexibility matrix method to analyze continuous beams.
2. Understand the concept of system approach of flexibility matrix method to analyze plane frames and trusses.
3. Understand the concept of system approach of stiffness matrix method to analyze continuous beams.
4. Understand the concept of system approach of stiffness matrix method to analyze plane frames.
5. Understand the concept of system approach of stiffness matrix method to analyze plane trusses.

**Pre-requisites:**

1. Analysis of Determinate Structures
2. Analysis of Indeterminate Structures

## UNIT I

**Fundamentals of Matrix Methods**

Static and Kinematic Indeterminacy; Introduction to flexibility and stiffness; Relationship between flexibility and stiffness, Properties of flexibility and stiffness matrices

**Analysis of Continuous Beams using Flexibility method (System Approach)**

Introduction to flexibility method, Development of flexibility matrix for a beam element using system/global approach, Analysis of continuous beams (static indeterminacy≤3); problems involving settlement of supports

**08 Hours**

## UNIT II

**Analysis of Frames and Trusses using Flexibility method (System Approach)**

Development of flexibility matrix for rigid frames and plane trusses by system/global approach, Analysis of frames and trusses (static indeterminacy≤3); problems involving sway force in frames and lack of fit in trusses

**08 Hours**

**Self Learning Topic:** Problems involving lack of fit in trusses

## UNIT III

**Analysis of Continuous Beams using Stiffness method (System Approach)**

Introduction to stiffness method, Development of stiffness matrix for a beam element using system/global approach, Analysis of continuous beams (kinematic indeterminacy≤3); problems involving settlement of supports

**08 Hours**

## UNIT IV

**Analysis of Frames using Stiffness method (System Approach)**

Development of stiffness matrix for a rigid frame using system/global approach, Analysis of plane frames (kinematic indeterminacy≤3); problems involving sway force

**08 Hours**

## UNIT V

**Analysis of Trusses using Stiffness method (System Approach)**

Development of stiffness matrix for a truss element using system/global approach, Analysis of plane trusses (kinematic indeterminacy≤3); problems involving temperature changes in trusses

**08 Hours**

**Self Learning Topic:** Problems involving temperature changes in trusses

### Text books


1. Bhavikatti S. S., "Matrix methods of Structural Analysis", I. K. International Publishing House Ltd, New Delhi, 2014 (ISBN 978-81141-35-9)
2. G. S. Pandit & S. P. Gupta, "Structural Analysis- A Matrix Approach"; Tata McGraw Hill Publishers, 1981
3. C. S. Reddy, "Basic Structural Analysis"; Tata McGraw Hill Publishers, 1996
4. L. S. Negi and R. S. Jangid, "Structural Analysis"; Tata McGraw Hill Publishers, 1997


### Reference Books


1. Weaver & Gere, "Matrix Analysis of Framed Structures"- CBS publishers and Distributors, 1986
2. Chu Kia Wang, "Analysis of Indeterminate structures", Tata McGraw Hill Publishers, 1952
3. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009

## Course Outcome (COs)

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | To **understand** the fundamentals of Matrix methods and **apply** the concept of system approach of flexibility matrix method to **analyze** continuous beams | **L2 L3 L5** |
| 2. | To **apply** the concept of system approach of flexibility matrix method to **analyze** plane frames and trusses | **L3 L5** |
| 3. | To **apply** the concept of system approach of stiffness matrix method to **analyze** continuous beams | **L3 L5** |
| 4. | To **apply** the concept of system approach of stiffness matrix method to **analyze** plane frames | **L3 L5** |
| | To **apply** the concept of system approach of stiffness matrix method to **analyze** plane trusses | **L3 L5** |

## Program Outcomes (POs)

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO3** |
| 3 | An ability to use the techniques, skills and modern engineering tools necessary for engineering practice | **PO11** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Assignment |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## STRUCTURAL DYNAMICS

| | | | |
|---|---|---|---|
| **Course Code** | 16CV742 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Understand the principles of Structural Dynamics
2. Recognize the degrees of freedom of systems and develop mathematical models
3. Evaluate the dynamic response of single degree and multi degree freedom systems
4. Understand concepts like resonance, damping, vibration isolation and mode shapes
5. Learn numerical methods of analysis

**Pre-requisites:**

1. Strength of materials
2. Structural analysis I and II

**Detailed Syllabus**

**UNIT I**

**Introduction to dynamics and dynamics of single degree of freedom systems (SDOF systems)**

Degrees of Freedom (DOF)- Examples of systems with single DOF and multiple DOF; Elements of an SDOF system; Dynamic characteristics of systems- frequency, period, amplitude, maximum/peak displacement, velocity and acceleration of vibration; D'Alembert's principle of dynamic equilibrium; Equation of motion (harmonic)- free vibration of an undamped SDOF system, free vibration of a damped SDOF system; Problems- to determine the dynamic characteristics of SDOF systems.

**08 Hours**

**UNIT II**

**Forced vibration of SDOF systems**

Equation of motion- SDOF system subjected to harmonic force, Amplitude of displacement, Frequency ratio, Resonance, Magnification factor; Transmissibility of vibrations (Displacement and Force) and Vibration isolation for harmonic vibration; Principle of working of seismic measurement instruments- Seismometer, Accelerometer; Response of SDOF system to arbitrary excitations- Duhamel integral solution applied to SDOF system subjected to suddenly applied load and triangular pulse load; Problems.

**08 Hours**

**Self learning topics:** Seismic Instruments.

**UNIT III**

**Free vibration of multi degrees of freedom (MDOF) systems**

Free vibration analysis of an undamped MDOF system, Natural frequencies (Eigen values/ frequencies) and Mode shapes (Eigen vectors/ modes), Orthogonality of normal modes of a MDOF system; Shear building- Concept, assumptions; Free vibration analysis of a shear building without damping; Problems- to determine natural frequencies and mode shapes of a shear building (max. 3 stories) without damping.

**08 Hours**

**UNIT IV**

**Forced vibration of multi degrees of freedom (MDOF) systems**

Generalized or Principal coordinates, Modal mass and Modal stiffness, Displacement of masses in generalized and absolute coordinates by mode superposition method; Analysis of a shear building-

without damping subjected to harmonic forces at floor levels using normal mode method, Stodola's numerical method of determining natural frequencies and mode shapes of an MDOF system; Problems.

**08 Hours**

**UNIT V**

**Forced vibration of mdof systems with damping and approximate methods**

Analysis of shear buildings with damping subjected to harmonic forces at floor levels, proportional damping; Stodola's method of determining natural frequencies and mode shapes of two-storey shear building

**08 Hours**

**Self learning topics:** Stodola's method of determining natural frequencies and mode shapes of three-storey shear building.

**Text Books**


1. Anil K. Chopra, "Dynamics of Structures" -Third Edition, Pearson Education
2. Madhujit Mukhopadhyay, "Structural Dynamics", Ane Books Pvt. Ltd.
3. Mario Paz, "Structural Dynamics", Second Edition, CBS Publishers & Distributors Pvt. Ltd.


**Reference Books**


1. Vinod Hosur, "Earthquake-Resistant Design of Building Structures", Wiley India Pvt. Ltd.
2. Ray W Clough and J Penzien, "Dynamics of Structures", 2nd Edition, Tata McGraw Hill, New Delhi.
3. Timoshenko S, "Vibration Problems in Engineering", Van-Nostrand Co.


**Course Outcome (COs)**

| | **At the end of the course, the student will be able to** | Bloom's Level |
|---|---|---|
| 1. | Understand and compare the behaviour of undamped, under-, critically- and over-damped systems. | **L2** |
| 2. | Recognize the degrees of freedom of systems and develop mathematical models. | **L3** |
| 3. | Apply the concepts of structural dynamics to seismic analysis of structures. | **L3** |
| 4. | Analyze systems using numerical methods such as Duhamel integral and Stodola's method. | **L4** |
| 5. | Determine the dynamic response of SDOF and MDOF systems under various types of loads. | **L5** |
| 6. | Design vibration isolation systems. | **L6** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO2 PO3** |
| 2. | Graduates shall possess the ability to review the research literature and analyze complex engineering problems. | **PO4** |
| 3. | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO3** |
| 4. | Graduates shall learn to apply the principals of engineering and management in multidisciplinary environment. | **PO3** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |

2. NPTEL/ Edusat
3. Power Point Presentation
4. Videos

2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| ➢ Writing two IA test is compulsory.<br>➢ **Minimum marks required to qualify for SEE : 20** | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## ADVANCED DESIGN OF R.C. STRUCTURES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV743 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Design of Combined Trapezoidal footing and Raft foundations.
2. Design the continuous and curved beams.
3. Design square and circular Bunkers.
4. Design of Flat Slabs**.**
5. Identify the critical sections in building frames, Design of Counter-fort retaining wall

**Pre-requisites:**

1. Elements of Civil Engineering.
2. Strength of Materials.
3. Analysis of Determinate Structures.
4. Analysis of Indeterminate Structures.
5. Design of R.C.C structures.
6. Design and Drawing of RCC Structures.

**Detailed Syllabus**

**UNIT I**

**Foundations**

Design of Combined footing- Trapezoidal and Strap-beam type

Design of Raft foundation – Conventional design method (Solid slab type only)

**08 Hours**

**UNIT II**

**Continuous beams**

Introduction, Effective span, Stiffness, Critical Sections, Loading Patterns, Moment Redistribution, Theoretical Values o f design moments, Practical values of design moments and Shear force, Bending Moment and shear force coefficients, Design of continuous beams without redistribution of moments

**Beams curved in plan**

Introduction, Analysis of bending and torsional moments in circular beams, Moments in semicircular beams supported on columns

**08 Hours**

**UNIT III**

**Design of bunkers**

Design principles of Bunkers, design of square and circular Bunkers.

**08 Hours**

**UNIT IV**

**Flat slabs**

Introduction, Proportioning of flat slabs, Determination of Bending Moment and shear force, direct design method.

**08 Hours**

**UNIT V**

**Building frames**

Introduction, Effective span, Stiffness, Loads, Loading combinations, Moment redistribution, Critical sections and RC details

**Counterfort retaining wall**

Design of Counterfort retaining wall

**08Hours**

**Self Learning Topics**: Design examples

**Text Books**


1. Bhavikatti S.S.**, "Advanced RCC Design "-** New Age International Pvt. Ltd.2006.
2. Krishnaraju.N., **"Advanced Reinforced Concrete Design"-** CBS Publications, New Delhi
3. Dr B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, **"Coamprehensive RCC Design"** Laxmi Publications, New Delhi


**Reference Books**


1. Varghese.P.C., **"Advanced Reinforced Concrete Structures",** Prentice hall of India Ltd, New Delhi
2. Shah & Karve, **"Limit State Theory & Design of Reinforced Concrete"**, Structure Publications, Pune.


**Course Outcome (COs)**

| **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|
| 1. **Understand** the **Design** principles of Foundations**.** | **L2** |

| | | |
|---|---|---|
| 2. | **Design** the continuous beams and Curved beams. | **L6** |
| 3. | **Design** the square and circular Bunkers. | **L6** |
| 4. | **Design** the Flat Slabs. | **L6** |
| 5. | **Analyze** the building frames and Design the Counterfort retaining walls. | **L4 L6** |

**Program Outcomes (POs) of the course**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts | **PO1** |
| 2 | Graduates shall possess the ability to review the research literature and analyze complex engineering problems | **PO2** |
| 3 | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| 4 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

**Course delivery methods**

1. Lecture and Board
2. Power Point Presentation
3. Videos

**Assessment methods**

1. Assignments and Open Book Tests
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |
| ➢ Writing two IA test is compulsory.<br>➢ **Minimum marks required to qualify for SEE : 20** | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## REINFORCED EARTH STRUCTURES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV744 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 3 –0 – 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives**

1. To understand the basics and history of reinforced earth construction.
2. Understanding the design of reinforced earth retaining walls
3. To understand the design of reinforced earth foundations and embankments.
4. To understand soil nailing and its design criteria.
5. To understand the design of filters drains using geosynthetics and its uses in landfills, in roads and slopes.

**Pre-requisites:**

1. Soil mechanics
2. Geotechnical engineering
3. Ground improvement techniques

**Detailed Syllabus**

### UNIT I

**Basics of reinforced earth construction**

Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil

**08 Hours**

### UNIT II

**Design of reinforced earth retaining walls**

Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, typical design problems

**08 Hours**

### UNIT III

**Design of reinforced earth foundations and embankments**

Foundations - Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines. Embankments - Concept of Reinforced Embankments, Internal and external stability, Selection of materials, typical design problems

**08 Hours**

### UNIT IV

**Soil nailing techniques**

Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken

**08 Hours**

**Self-study topic:** Concept, Advantages & limitations of soil nailing techniques.

## UNIT V

**Geosynthetics - filter, drain and landfills**

Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability. Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps

**Geosynthetics for roads and slopes roads:** - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique.

**08 Hours**

**Text Books**


1. Design with geosynthetics- Koerner. R.M. - Prince Hall Publication, 2005
2. Construction and Geotechnical Engineering using synthetic fabrics- Koerner. R.M. & Wesh, J.P., Wiley Inter Science, New York, 1980.
3. An introduction to Soil Reinforcement and Geosynthetics – Sivakumar Babu G. L., Universities Press, Hyderabad, 2006
4. Reinforced Soil and its Engineering Applications, Swami Saran, I. K. International Pvt. Ltd, New Delhi, 2006
5. Engineering with Geosynthetics- Venkattappa Rao, G., & Suryanarayana Raju., G. V.S. - Tata Mc Graw Hill publishing Company Limited., New Delhi.


**Reference Books**


1. Earth reinforcement and Soil structure- Jones CJEPButterworth, London, 1996.
2. Geotextile Hand Book- Ingold, T.S. & Millar, K.S. - Thomas, Telford, London
3. Earth Reinforcement Practices - Hidetoshi Octial, Shigenori Hayshi & Jen Otani -Vol. I, A.A. Balkema, Rotterdam, 1992
4. Ground Engineer's reference Book- Bell F.G. - Butterworths, London, 1987.
5. Reinforced Earth- Ingold, T.S. - Thomas, Telford, London Geosynthetics in Civil Engineering, Editor Sarsby R W, Woodhead Publishing Ltd & CRC Press, 2007


**Course Outcome (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | Graduates shall be able to **understand** the construction of reinforced earth structures | **L1 L2** |
| 2. | Graduates shall be able to **design** the reinforced earth retaining walls | **L1 L2 L3 L6** |
| 3. | Graduates shall be able to **understand** and **explain** about sol nailing | **L2 L3 L5** |

**Program Outcome of this course (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall possess the ability to review the research literature and analyze | **PO2** |
| 3 | complex engineering problems<br>Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. Power-point Presentation | 2. Quizzes |

3. Videos
4. NPTEL / Edusat

3. Internal Assessment Tests
4. Semester End Examination (SEE)

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100)**
3. Question paper contains 10 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## GROUND WATER HYDROLOGY

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV745 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3 – 0 – 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs):**

1. Describe the vertical distribution of surface water
2. Illustrate the basic parameters of aquifer
3. Apply the concepts of Darcy's law to one dimensional flow
4. Illustrate the basic concepts of steady flow in confined and unconfined aquifers
5. Demonstrate the various methods for unsteady flow in wells

**Pre-Requisites:**

1. Hydrology and Irrigation Engineering
2. Hydraulics

**Detailed Syllabus**

### UNIT I

Importance. Vertical distribution of sub-surface water. Definition of aquifer, Aquifuge, Aquitard and Aquiclude. Confined and unconfined aquifers. Artificial recharge. Ground water runoff. Ground water budget.

Aquifer parameters – Specific yield, Specific retention, Porosity, Storage coefficient, derivation of the expression. Determination of specific yield. Land subsidence due to ground water withdrawals

**08 Hours**

**Self Learning Topic:** Land subsidence due to ground water withdrawals.

## UNIT II

**Darcy's law and hydraulic conductivity**

Introduction. Darcy's law. Hydraulic conductivity. Coefficient of permeability and Intrinsic permeability, Transmissibility, Permeability in Isotropic, Unisotropic layered soils. Steady one dimensional flow, different cases with recharge

**08 hours**

**Self Learning Topic:** Recharge

## UNIT III

**Well hydraulics – steady flow**

Introduction. Steady radial flow in confined and unconfined aquifers. Pumping tests

**08 Hours**

**Self Learning Topic:** Pumping tests

## UNIT IV

**Well hydraulics – unsteady flow**

Introduction. General equation derivation; Theis method, Cooper and Jacob method, Chow's method. Solution of unsteady flow equations

**08 Hours**

**Self Learning Topic:** Theis method

## UNIT V

**Ground water exploration**

Seismic method, Electrical resistivity method, Bore hole geo-physical techniques; Electrical logging, Radio active logging, Induction logging, Sonic logging and Fluid logging.

**Ground water development**

Types of wells. Methods of constructions. Tube well design. Dug wells. Pumps for lifting water: Working principles, Power requirements

**08 Hours**

**Self Learning Topic:** pumps for lifting water

**Text books**


1. Ground Water- H.M. Raghunath, - Wiley Eastern Limited, New Delhi.
2. Ground Water Hydrology- K. Todd, - Wiley and Sons, New Delhi.
3. Numerical Ground Water Hydrology- A.K. Rastogi, - Penram, International Publishing (India), Pvt. Ltd., Mumbai.


**Reference books**


1. Ground Water Hydrology- Bower H.- McGraw Hill, New Delhi.
2. Ground Water and Tube Wells- Garg Satya Prakash, - Oxford and IBH, New Delhi.
3. Ground Water Resource Evaluation- W.C. Walton, - McGraw Hill - Kogakusha Ltd., New Delhi.
4. Water wells and Pumps – Michel D.M., Khepar. S.D., Sondhi. S.K., McGraw Hill Education – 2nd Edition


### Course Outcome (COs)

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | To **Outline** the vertical distribution of subsurface water | **L2** |
| 2. | To **Solve** and **Evaluate** the aquifer parameters | **L3 L5** |
| 3. | To **Summarize** the concept of Darcy's law and **Solve** one dimensional flow problems | **L2 L3** |
| | To **Develop** drawdown equation for steady flow in confined and unconfined aquifers | **L3** |
| | To **Solve** for aquifer parameters in a unsteady flow using various methods | **L3** |

To **Demonstrate** the various ground water exploration methods **L6**

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall possess effective oral and written communication skills | **PO10** |
| 2 | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | **PO4** |
| 3 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

**Course delivery methods**

1. Lecture and Board
2. Power-point Presentation
3. Videos
4. NPTEL / Edusat

**Assessment methods**

1. Assignments and Open Book Tests
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination (SEE)

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 | 50 |

- Two IA tests are compulsory.
- Minimum marks required to qualify for SEE : Minimum IA test marks (average) 10 out of 25 and total CIE marks 20 out 50

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. SEE will be conducted for 100 marks and scaled down to 50 marks for the calculation of SGPA and CGPA
2. Minimum marks required in SEE to pass: 40 out of 100
3. Question paper contains 08 questions, each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (from any TWO UNITS) and choice will be given in the remaining three units.

## GROUND IMPROVEMENT TECHNIQUES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV746 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 3 –0 – 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives**

1. To understand the importance ground improvement technique
2. To understand effect of compaction of soils.
3. To understand the process of chemical stabilization.
4. To understand grouting materials and techniques.
5. To understand the concept of earth reinforcement.

**Pre-requisites:**

1. Soil Mechanics
2. Geotechnical engineering

**Detailed Syllabus**

**UNIT I**

**Introduction**

Definition of Ground improvement, objectives of ground improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique.

**08 Hours**

**UNIT II**

**Compaction**

Effect of grain size distribution on compaction for various types soils. Effect of compaction on engineering behavior like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. Field compaction – static, dynamic, impact and vibratory type. Specification of compaction. Tolerance of compaction. Shallow and deep compaction, Dynamic Compaction, Vibrofloatation

**08 Hours**

**Self learning topic:** Study of field compaction equipments.

**UNIT III**

**Chemical modification**

Definition, cement stabilization. Hydration–effect of cement stabilization on permeability, swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid.

**08Hours**

**UNIT IV**

**Grouting**

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

**08 Hours**

**Self learning topic:** Case Study on grouting techniques.

**UNIT V**

**Reinforced earth techniques**

Principles, concepts and mechanism of reinforced earth materials, Design considerations for reinforced earth structures. Reinforced earth construction. Geosynthetic materials-Types, Functions, property characterization, testing methods for geosynthetic materials, Geotextiles, Geomembranes, Geogrids, Geonets and Geocells

**08 Hours**

**Text Books**


1. Ground ImpovementTecnniques-Purushotham Raj (1999) Laxmi Publications, New Delhi.
2. An introduction to ground improvement engineering-Satyendra Mottal, Scientific International Pvt.Ltd.NewDelhi.
3. Soil Improvement Techniques and their evolution-W .F.Vanlmpe, A.A.Bakema, Rotterdam, Netherlands.

**Reference Books**

1. Engineering Principles of ground modification-Manfred Haussmann (1990) – McGraw Hill Pub.Co., New York.
2. Expansive soils-Nelson .J.D. and Miller.D.J. (1992)- John Wiley and Sons.
3. Soil stabilization; Principles and Practice-Ingles.C.G.and Metcalf .J.B (1972)-Butterworth, London.

**Course Outcome (COs)**

| | **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|---|
| 1. | Graduates shall be able to **Understand** ground improvement techniques and know about the method to be adopted for different soils. | **L1 L2 L3** |
| 2. | Graduates shall be able to **Define** compaction and **Understand** the different methods of compaction equipment used for achieving it in field | **L1 L2 L3 L5** |
| 3. | Graduates shall be able to **Illustrate** about chemical modification and use of lime and cement for soil stabilization | **L2** |
| 4. | Graduates shall be able to **Explain** about grouting and types and materials used for it also its application | **L2 L3 L4 L5** |
| 5. | Graduates shall be able to **Explain** about reinforced earth techniques and geosynthetics. | **L2** |

**Course delivery methods**

1. Lecture and Board
2. Power-point Presentation
3. Videos
4. NPTEL / Edusat

**Assessment methods**

1. Assignments and Open Book Tests
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination (SEE)

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| ➢ Two IA tests are compulsory.<br>➢ **Minimum marks required to qualify for SEE : 20** | | | | | |

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**
3. Question paper contains 10 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## SOLID WASTE MANAGEMENT

| | | | |
|---|---|---|---|
| **Course Code:** | 16CV747 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3–0– 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Understand the importance of solid waste management
2. Outline the hierarchy involved in solid waste management
3. Describe the inceration, pyrolsis and composting methods adopted
4. Explain the step involved in selecting sanitary landfill
5. Illustrate the material that can be recycled and reused

**Prerequisites:**

1. Environmental Studies

**Detailed Syllabus**

### UNIT I

**Introduction**

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

**Sources**

Classification and characteristics- municipal waste

**08 Hours**

**Self learning Topic:** Scope and Importance of solid waste management

### UNIT II

**Collection and transportation**

Systems of collection, collection equipment, garbage chutes, transfer stations — bailing and compacting, route Optimization

**Treatment/processing techniques**

Components separation, volume reduction, size reduction, chemical reduction and biological processing

**08 Hours**

### UNIT III

**Disposal methods**

Open dumping - selection of site, ocean disposal, feeding to hogs, incineration, pyrolsis, composting.

**08 Hours**

### UNIT IV

**Sanitary land filling**

Definition, methods, trench area, Rant, and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate collection and control methods, gas collection systems.

**08 Hours**

### UNIT V

**Recycle and reuse**

Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.

**08 Hours**

**Self learning Topic:** Environmental significance and reuse.

**Text Books**

1. Tchobanoglous – **"Integrated Solid Waste Management",** McGraw Hill, 2002
2. Tchobanoglous **-"Handbook of solid waste management"**, McGraw Hill Publishers, 2nd edition.

**Reference Books**

1. Edmed B. B –**"The treatment of industrial wastes"**, Tata McGraw Hill, New Delhi.
2. Trived.P.R & Garedeep R.-**"Solid Waste Pollutions"**, Aakashdeep Publishing House, New Delhi.

**Course Outcome (COs)**

| | **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|---|
| 1. | **Justify** the importance of Solid waste management for urban areas and rural areas. | **L5** |
| 2. | Along with flow chart **Explain** the steps involved in solid waste management. | **L2** |
| 3. | **Explain** the different Disposal methods used in disposing solid waste | **L2** |
| 4. | **Justify** the importance of Sanitary landfill and **Describe** the monitoring of sanitary landfill | **L2 L5** |
| 5. | **Explain** the importance of recycle and reuse in solid waste management. | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO5** |

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. Power-point Presentation | 2. Quizzes |
| 3. Videos | 3. Internal Assessment Tests |
| 4. NPTEL / Edusat | 4. Semester End Examination (SEE) |

**Scheme of Continuous Internal Evaluation (CIE):**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**

## PAVEMENT MATERIALS AND CONSTRUCTION

| | | | |
|---|---|---|---|
| **Course Code** | 16CV748 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 3 –0 – 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. To study the properties of aggregates and their relevance in pavement performance.
2. To ascertain the suitability of plain and modified bitumen in pavement construction.
3. To understand the characteristics and uses of emulsions and cutbacks.
4. To understand the mix design of bituminous mixes.
5. To gain the knowledge of various equipments used in highway construction.
6. To study the preparation of sub grade and quality control tests.
7. To gain the knowledge of materials, understand the construction methods and field control checks on flexible pavement and concrete pavement.

**Pre-requisites**

Transportation Engineering –I

**Detailed Syllabus**

### UNIT I

**Aggregates**

Origin, classification, requirements, concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending to meet specification.

**Bitumen and tar**

Origin, preparation, properties and chemical constitution of bituminous road binders; requirements

**08 Hours**

**Self Learning Topics:** Properties and tests on road aggregates

### UNIT II

**Bituminous Emulsions and Cutbacks**

Preparation, characteristics, uses and tests of emulsion and cutbacks. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion

**08 Hours**

### UNIT III

**Bituminous Mixes**

Mechanical properties, dense and open textured mixes, flexibility and brittleness, (Excluding Hveem Stabilometer & Hubbar – Field Tests) bituminous mix, design methods using Rothfuch's Method only and specification using different criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. **08 Hours**

## UNIT IV

**Equipments in Highway Construction**

Grading and compaction, their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

**08 Hours**

**Self Learning Topics:** Various types of equipment for excavation

## UNIT V

**Flexible Pavements**

Specifications of materials, construction method and field control checks for various types of flexible pavement layers.

**Cement Concrete Pavements**

Specifications and method of cement concrete pavement construction; Quality control tests; Construction of various types of joints.

**08 Hours**

**Text Books**


1. Khanna S. K., C. E. G. Justo and Veeraragavan A., "Highway Engineering", Nemchand and Bros. Roorkee, Revised Tenth Edition, 2015.
2. Sharna S. C., " Construction Equipment and its Management", Khanna Publishers


**Reference Books**


1. Kadiyali L. R. and Lal N. B., "Principles and practices of Highway Engineering", Khanna publishers. VII Edition, 2001.
2. R. Srinivasa Kumar, "Textbook of Highway Engineering", Universities Press, 1st published 2011.
3. Relevant IS codes and MoRT & H specifications.


**Course Outcome (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | **Explain** the properties of aggregates and their relevance in pavement performance. | **L2** |
| 2. | **Explain** the suitability of plain and modified bitumen in pavement construction. | **L1 L2** |
| 3. | **Explain** the characteristics and uses of emulsions and cutbacks. | **L1 L2 L3** |
| 4. | **Design** the mix proportions of bituminous mixes. | **L6** |
| 5. | **Explain** the use of various equipments used in highway construction. | **L2 L5** |
| 6. | **Explain** the construction methods and field control checks for flexible and rigid pavements | **L2 L4 L6** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| **1.** | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| **2.** | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO3** |
| **3.** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO5** |

| | | |
|---|---|---|
| **4.** | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability. | **PO7** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| | Course delivery methods | | Assessment methods |
|---|---|---|---|
| 1. | Lecture and Board | 1. | Assignments and Open Book Tests |
| 2. | Power-point Presentation | 2. | Quizzes |
| 3. | Videos | 3. | Internal Assessment Tests |
| 4. | NPTEL / Edusat | 4. | Semester End Examination (SEE) |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## ELECTIVE IV
## FINITE ELEMENT ANALYSIS

| | | | |
|---|---|---|---|
| **Course Code:** | 16CV751 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3– 0 – 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives**

1. Understand the process of Finite Element Analysis by gaining the knowledge of types of elements, energy concepts, matrix displacement formulation.
2. Achieve Knowledge of displacement functions, natural coordinates, shape functions by various methods.
3. Understand strain displacement matrix, stiffness matrix and nodal vector.
4. Impart the knowledge and information about FEA so that the students can make use of it in Designing and analyzing a real life project.

**Pre-requisites:**

1. Strength of Materials
2. Matrix Methods of Structural Analysis

3. Theory of Elasticity and Plasticity

Detailed Syllabus

**UNIT I**

Basic Concepts of FEM, Brief History of FEM, comparison of FEM with other Methods, Structure of computer program for FEM analysis, pre and post processing. Discussion of FEM software

**08 Hours**

**Self Learning Topic**: Study of FEM softwares

**UNIT II**

Basic elements & Co-ordinate system (1D, 2D & 3D) used in FEM, Element aspect ratio, mesh refinement and higher order elements, numbering of nodes to minimize band width, Displacement functions, Natural Coordinates, displacement functions for Natural Co-ordinates of various elements. Convergence and compatibility requirements

**08Hours**

**UNIT III**

Shape functions for various elements by using generalized coordinates approach, Polynomials and by using Natural Coordinates, Shape functions for various elements (1D, 2D & 3D) by using Lagrangian, Serendipity and Hermitian concepts, Degradation Technique.

**08 Hours**

**Self Learning Topic**: Shape function by using Hermitian concepts

**UNIT IV**

Strain-Displacement Matrix, Stiffness matrix formulation for CST and four-noded quadrilateral elements; Iso-parametric, sub-parametric and super-parametric elements. Stiffness matrix, Coordinates transformation, convergence requirement for iso-parametric elements

**08 Hours**

**UNIT V**

Applications of FEM for the analysis of 1-D and 2-D problems- Formulation of constitutive matrix and stress computation, numerical integration - characteristics of iso-parametric quadrilateral elements

**08 Hours**

**Text Books**


3. Robert D Cook, David S Malkus, Michael E Pleasha& Robert J Witt, **"Concepts and Applications of FEA"**- Fourth Edition Wiley India Pvt Ltd New Delhi 2014.
4. Krishnamoorthy – **"Finite Element Analysis– Theory and Programming**", Second Edition Tata McGraw Hill Co. Ltd., New Delhi 2005.
5. J.F. Abel and Desai. C.S, **"Introduction to the Finite Element Method"**, Second Edition CBS Publisher, New Delhi 2000.
6. Daryl L. Logan, **"A first course in the Finite Element Methods"**,Fifth Edition Cengage Publisher New Delhi 2012.


**Reference Books**


1. Rajasekharan.S, **"Finite element analysis in engineering design",** First Edition Allahabad Wheeler Publishing 1993.
2. Bathe K.J, **"Finite Element Procedures"**, Second Edition PHI Pvt. Ltd., New Delhi 2001.
3. Zienkeiwicz. O.C., **"The Finite Element Method"**, Second Edition Tata McGraw Hill Co. Ltd., New Delhi 2003.

4. S.S. Bhavikatti, **"Finite Element Analysis",** First Edition New Age International Publishers, New Delhi 2009.

**Course Outcomes (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1 | **Explain** the Back ground of FEA and its applications in structural analysis | **L2** |
| 2 | **Discuss** displacement functions, natural coordinate applications of FEA | **L6** |
| 3 | **Formulate** the shape functions for various elements by various approaches | **L6** |
| 4 | **Explain** the structure of computer programming for FEA and processor(Pre and Post) | **L2** |
| 5 | **Apply** FEA concepts in Designing and analyzing real life problems | **L3** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| **1** | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO1** |
| **2** | Graduates shall possess the ability to review the research literature and analyse complex engineering problems | |
| **3** | Graduates shall be able to design and conduct experiments and interpret the results as per the current research | |
| **4** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| **5** | **Apply** FEA concepts in Designing and analyzing real life problems | |

**Content Delivery/Assessments methods and Scheme of Evaluation**

**Course delivery methods**

1. Lecture and Board
2. Power Point Presentation
3. Videos

**Assessment methods**

1. Assignments and Open Book Tests
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation |
|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 05 | 10 |
| ➢ Writing two IA test is compulsory.<br>➢ **Minimum marks required to qualify for SEE : 20** | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:**

3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## BRIDGE ENGINEERING

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV752 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3 – 0 – 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours |

**Course Learning Objectives (CLOs):**

1. Understand the Essentials of bridge engineering
2. Develop skills to analyze super-structure
3. Develop skills to analyze sub-structure
4. Develop skills to reinforcement detailing of bridges

### UNIT I

**Introduction**

Selection of Bridge site and planning, Classification of bridges, Highway Bridge Loading Standards, Impact Factors. Bridge substructures: Pier; Abutment; Wing walls;

**Bridge Bearings**

General features, Types of bearings, Design principles of Steel Rocker and Roller Bearings, Reinforced Concrete Rocker Bearing and Elastomeric Pad & Pot Bearing.

**08 Hours**

**Self Learning Topics:** Detailing of foundation reinforcements.

### UNIT II

**Box and slab Culvert**

Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading. Working out the worst combination of loading, Moment Distribution, Calculation of BM & SF, Structural design by limit state method, with Reinforcement Details

**08 Hours**

### UNIT III

**T Beam Bridge Slab Design**

Proportioning of Components Analysis of interior Slab & Cantilever Slab Using IRC Class AA Tracked, Wheeled and Class A Loading. Structural design by limit state method, with Reinforcement Details

**08 Hours**

### UNIT IV

**Beam Bridge Main Girder Design**

Analysis of Main Girder for Dead Load & Live Load Using IRC Class AA Tracked, Wheeled and Class A Loading Using COURBON'S Method, BM & SF for different loads, Structural design by limit state method, with Reinforcement Details.

**T Beam Bridge Cross Girder Design**

Analysis of Cross Girder for DeadLoad & Live Load Using IRC Class AA Tracked, Wheeled, Class A Loading, Structural design of beam by limit state method, with Reinforcement Details

**08 Hours**

## UNIT V

**Cable Stayed Bridges**

General features, Components of Cable Stayed Bridges, Towers or Pylons, Types of Cable Stays, Longitudinal Cable Arrangement, Advantages of Cable Stayed Bridges, Basic concepts of Structural analysis and Structural anchorages.

**08 Hours**

**Self Learning Topics:** Detailing of cable stayed bridges.

**Text Books:**


1. D Johnson Victor, **"Essentials of Bridge Engineering**", Oxford & IBH Publishing Co New Delhi., Sixth edition, 2007
2. N Krishna Raju, "**Essentials of Bridge Engineering**", Oxford & IBH Publishing Co New Delhi., Sixth edition, 2010
3. S P Bindra, **"Principles and Practice of Bridge Engineering**" Dhanpat Rai & Sons, New Delhi., Second edition, 2011
4. Raina V.K., "**Concrete Bridge Practice"-** Shroff Publishers and Distributors Pvt. Ltd; Third edition (13 November 2007)


**References:**


1. IRC 6 – 2000 "**Standard Specifications And Code Of Practice For Road Bridges"** Section II Loads and Stresses, The Indian Road Congress New Delhi.
2. IRC 21 – 2000 **"Standard Specifications And Code Of Practice For Road Bridges"-**Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
3. IRC:112 –2011 " **Code Of Practice for Concrete Road Bridges**", The Indian Road Congress New Delhi.
4. IS 456 – 2000 "**Indian Standard Plain and Reinforced Concrete Code of Practice**"- (Fourth Revision) BIS New Delhi
5. IS 1343-2012 – **"Indian Standard Prestressed Concrete Code of Practice**"-BIS New Delhi


### Course Outcomes (COs)

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1 | **Describe** the load flow mechanism and **identify** loads on bridges. | **L2** |
| 2 | **Develop** understanding and appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality | **L6** |
| 3 | **Develop** an intuitive feeling about the sizing of bridge elements, ie. Develop a clear understanding of conceptual design | **L6** |
| 4 | **Design** of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements | **L6** |

### Program Outcome (POs)

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO 1** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO 5** |

**Scheme of Continuous Internal Evaluation (CIE):**
The Total marks of CIE shall be 50 (Three tests of 25 marks each), two assignments of 10 marks each, two Quizzes of 05 marks each and 10 marks class participation

| Components | Average of best performance in tests | 2 Assignments of 10 marks each | Quiz | Class participation |
|---|---|---|---|---|
| **Maximum Marks** | 25 | 10 | 05 | 10 |

**Scheme of Semester End Examination (SEE):**
Semester end examination of three hour duration. Two questions to be set from each unit. SEE question paper will have two compulsory questions from any two units. Total five questions to be answered out of 8 questions selecting one question from each unit. All questions carry equal marks.

## EARTHQUAKE RESISTANT STRUCTURES

| | | | |
|---|---|---|---|
| **Course Code** | 16CV753 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course learning objectives**
1. Understand engineering seismology.
2. Understand quantification and measurement of earthquake ground motions.
3. Understand the concept and use of Response Spectrum.
4. To determine seismic forces on a building structure.
5. Know the various structural irregularities in building structures.
6. Learn earthquake resistant construction practices for masonry and RCC structures.
7. Understand the various seismic analysis procedures.

**Pre-requisites**
Structural Dynamics

### UNIT I

**Introduction to engineering seismology and earthquake resistant design of structures**
Interior structure of earth; Plate tectonic theory; Plate boundaries; Reid's elastic rebound theory; Geological and tectonic features of India; Important terms- Hypocenter, Epicenter, Epicentral distance; Origin and propagation of different types of seismic waves; Characteristics of earthquake and its quantification- Magnitude and Intensity scales; Seismic instruments; Structural behavior under gravity and seismic loads; Lateral load resisting structural systems; Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.

**08 Hours**

**Self Learning Topics:** Interior structure of earth; geological and tectonic features of India.

### UNIT II

**Response spectra and seismic forces on simple buildings**
The Response history and strong motion characteristics; Response Spectrum- elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake

resistant design; Computation of seismic forces in multi-storeyed buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893: 2002 (Part 1).

**08 Hours**

**UNIT III**

**Structural irregularities**

Flow of seismic forces in a structure; Concept of plan irregularities and vertical irregularities; Design provisions for Soft storey and Torsion in buildings in IS-1893; Effect of infill masonry walls on frames, modeling concepts of infill masonry walls; Behavior of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.

**08 Hours**

**Self Learning Topics:** Concepts for earthquake resistant masonry buildings.

**UNIT IV**

**Design of reinforced concrete buildings for earthquake resistance**

Load combinations; Ductility and energy absorption in buildings; ductile detailing provisions as per IS-1893, design beams for ductility; Structural behavior, design and ductile detailing of shear walls.

**08 Hours**

**UNIT V**

**Seismic analysis procedures**

Seismic demand, seismic capacity; Overview of linear and nonlinear procedures of seismic analysis, Performance Based Seismic Engineering methodology

**08 Hours**

**Text Books**


1. Vinod Hosur, "Earthquake Resistant Design of Building Structures", WILEY (India).
2. Pankaj Agarwal and Manish Shrikande "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd., New Delhi.
3. S K Duggal, "Earthquake Resistant Design of Structures", Oxford University Press.


**Reference Books**


1. Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw Hill Publications.
2. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993.


**Course Outcome (COs)**

| | **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|---|
| 1 | Explain the geological and seismological aspects of earth, causes and types of earthquakes and their quantification, and engineering seismology | **L2** |
| 2 | Apply the concept of Response Spectrum in seismic analysis and design of structures. | **L3** |
| 3 | Determine seismic forces on a building structure as per IS 1893- 2002 (Part 1). | **L5** |
| 4 | Identify irregularities in structures as per IS 1893- 2002 (Part 1), their effect on structures and also suggest solutions to account for them in design. | **L3 L4** |
| 5 | Explain behaviour and earthquake resistant construction of masonry buildings under seismic forces. | **L2** |
| 6 | Carry out ductile detailing of RCC elements as per IS 13920- 1993. | **L6** |
| 7 | Explain and Compare various methods of seismic analysis procedures. | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO 2**<br>**PO 3** |
| 2 | Graduates shall possess the ability to review the research literature and analyze complex engineering problems. | **PO 4** |
| 3 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO 3** |
| 4 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO 3** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. NPTEL/ Edusat | 2. Quizzes |
| 3. Power Point Presentation | 3. Internal Assessment Tests |
| 4. Videos | 4. Semester End Examination |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| ➢ Writing two IA test is compulsory.<br>➢ **Minimum marks required to qualify for SEE : 20** | | | | | |

**Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.**

**Scheme of Semester End Examination (SEE):**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. (Kindly MODIFY the changes in the pattern of SEE question paper, if required)

## ADVANCED FOUNDATION DESIGN

| | | | |
|---|---|---|---|
| **Course Code** | 16CV754 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 marks |
| **Hours/week: L-T-P** | 3 –0 – 0 | **SEE Marks** | 50 marks |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours for 100 marks |

**Course Learning Objectives-**

1. To understand bearing capacity of soil for different foundation types and settlements
2. To understand principles and design of shallow foundation
3. To understand design of pile foundation and their application.
4. To understand the pile foundation in group and their efficiency.
5. To understand the aspects of well foundation.

**Pre-requisites:**

1. Geotechnical engineering
2. Design of RCC structures
3. Building materials and construction

### UNIT I

**Bearing capacity & settlement**

Presumptive bearing capacity according to BIS, Factors affecting bearing capacity, Factors influencing selection of depth of foundation, types of shallow foundations, Settlement of Shallow Foundations: Immediate, consolidation, & differential settlements, Factors influencing settlement, Safe Bearing Capacity and Allowable Bearing Pressure.

**08 Hours**

### UNIT II

**Shallow foundations**

Principles of Design of foundation, Definition for Shallow and Deep foundation, Requirements for geotechnical and structural aspects of design, Proportioning of isolated footing, combined footing, Strap footing, Strip footing and Raft foundation

**08 Hours**

### UNIT III

**Pile foundations – Single pile**

Historical Development, Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests, Laterally Loaded Pile.

**08 Hours**

**Self-study topic:** Historical Development of piles.

### UNIT IV

**Pile foundations – Group effect**

Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, under reamed piles, testing of piles – pile load test and cyclic pile load test

**08 Hours**

### UNIT V

**Well foundations** Historical Development, Different shapes and characteristics of wells, Components of well foundation. Forces acting on well foundation. Stability of wells. Sinking of wells. Causes and remedies for tilts and shifts.

**08 Hours**

**Self-study topic:** Historical Development, Different shapes and characteristics of wells, Components of well foundation.

**Text Books**

1. Soil Mechanics & Foundation Engineering - V.N.S. Murthy - Pub: Sai Tech.
2. Foundation Engineering - Braja M. Das – Cengage Learning.
3. Soil Mechanics Foundations - Dr. B.C. Punmia - Pub :Laxmi publications, pvt. Ltd.

**Reference Books**

1. Foundation Analysis and Design - Bowles J.E. (1996) - 5th Ed, McGraw Hill Pub. Co., New York.
2. Advanced Foundation Engineering - V.N.S. Murthy - Pub :Sai Tech.
3. Pile Foundation.-Chellies
4. Geotechnical Engineering.- P. Purushotham Raj
5. Geotechnical Engineering - Dr. C. Venkataramaiah - Pub : New age Publications.
6. Foundation Engineering - Dr. P.C. Varghese :- Pub : Prentice Hall of India

**Course Outcome (COs)**

| **At the end of the course, the student will be able to** | **Bloom's Level** |
|---|---|
| 1. Graduates shall be able to **understand** bearing capacity and settlement of soils under different conditions | **L1 L2 L3** |
| 2. Graduates shall be able to **understand** the design of shallow foundation and its types. | **L1 L2 L3 L5** |
| 3. Graduates shall be able to summarize and **explain** the necessity of pile foundation and its classification. | **L2 L3, L4 L5** |
| 4. Graduates shall be able to **explain and study** about the group effect of piles**.** | **L2 L3, L4 L5** |
| 5. Graduates shall be able to **illustrate** about well foundation. | **L2** |

**Program Outcome (POs)**

| | | |
|---|---|---|
| **1.** | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |
| **2.** | Graduates shall possess the ability to review the research literature and analyze complex engineering problems | **PO3** |
| **3.** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures**.** | **PO5** |

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. Power-point Presentation | 2. Quizzes |
| 3. Videos | 3. Internal Assessment Tests |
| 4. NPTEL / Edusat | 4. Semester End Examination (SEE) |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | Average of assignments (Two) / activity | Quiz | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum marks required in SEE to pass:40 (out of 100 )
3. Question paper contains 10 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## INDUSTRIAL WASTEWATER TREATMENT

| | | | |
|---|---|---|---|
| **Course Code:** | 16CV755 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3–0– 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 marks |

**Course Learning Objectives (CLOs)**

1. Students will be able to evaluate waste water.
2. Design effluent treatment plant, select suitable discharge sites, design complete process package for a given industry.

**Pre-requisites:**

1. Waste water Engineering

### UNIT I

**Introduction**

Difference between Domestic and Industrial Wastewater, Effect on Streams and on Municipal Sewage Treatment Plants. Stream Quality, Dissolved Oxygen Sag curve in Stream, Streeter - Phelps formulation, Stream Sampling, effluent and stream Standards and Legislation to Control Water Pollution

**08 Hours**

### UNIT II

**Treatment methods**

Volume Reduction, Strength Reduction, Neutralization, Equalization and Proportioning. Removal of Inorganic suspended solids, Removal of Organic Solids, Removal of suspended solids and colloids. Treatment and Disposal of Sludge Solids

**08 Hours**

### UNIT III

**Combined treatment**

Feasibility of combined Treatment of Industrial Raw Waste with Domestic Waste, Discharge of Raw, Partially Treated and completely treated Wastes to Streams

**08 Hours**

### UNIT IV

**Treatment of selected industrial wastes**

Process flow sheet showing origin / sources of waste waters, Characteristics of waste alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of waste disposal on water bodies **08 Hours**

## UNIT V

**Process flow chart & wastewater treatment unit**

Sugar Industry, Dairy Industry, Brewery and Distillery Industry, Paper and Pulp Industry, Pharmaceutical Industry

**08 Hours**

**Text Books:**


1. Nelson L Nemerow- **"Industrial Waste Water Treatment"**, Butterworth heinemann publisher, 2006
2. Rao MN, and Dutta AX- **"Industrial Waste Water Treatment"**, McGraw–Hill, *Publishing* Company Limited, First Edition, 2005


**Reference Books:**


1. Mahajan S.P- **"Pollution Control Processes in industries"**


**Course Outcomes (COs)**

| | At the end of the course, the student will be able to | **Bloom's Level** |
|---|---|---|
| **1** | **Characterize** the effluents/waste water | **L4** |
| **2** | **Determination** of critical dissolved oxygen deficit and oxygen sag curve. | **L3** |
| **3** | **Adopt** various physical, chemical and biological processes for industrial waste water treatment. | **L5** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| **1** | **Graduates** shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO 1** |
| **2** | **Graduates** shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO 5** |

**Scheme of Continuous Internal Evaluation (CIE)**

The Total marks of CIE shall be 50 (Three tests of 25 marks each), two assignments of 10 marks each, two Quizzes of 05 marks each and 10 marks class participation

| **Components** | **Average of best performance in tests** | **2 Assignments of 10 marks each** | **Quiz** | **Class participation** | **Total Marks** |
|---|---|---|---|---|---|
| **Maximum Marks** | 25 | 10 | 05 | 10 | 50 |

**Scheme of Semester End Examination (SEE):**

Semester end examination of three hour duration. Two questions to be set from each unit. SEE question paper will have two compulsory questions from any two units. Total five questions to be answered out of 8 questions selecting one question from each unit. All questions carry equal marks.

## PAVEMENT DESIGN

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV756 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3 – 0– 0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 03 hours |

**Course Learning Objectives**

1. To understand the importance of flexible pavements and rigid pavements.
2. To interpret fundamental design components of flexible pavements and rigid pavements.
3. To learn the different design methods of flexible pavements.
4. To learn the different design methods of rigid pavements.
5. To analyze the failures, causes and maintenance works for flexible pavements and rigid pavements.

**Pre-requisites:**

1. Highway Engineering
2. Geotechnical Engineering

### UNIT I

**Introduction**

Flexible pavement: Characteristics, components, requirements, functions of each component layers. Comparison between flexible pavement and rigid pavement.

Rigid pavement: Characteristics, components, requirements, functions, Difference between highway pavement and airfield pavement.

**08 Hours**

**Self-Learning Topics:** Air field pavements for different airports

### UNIT II

**Design Fundamentals of Pavements**

Flexible pavements: Design life, factors affecting design, stresses and deflections, Boussinesqs theory-principle-assumptions-limitations and problems, Burmister two layered theory, assumptions, problems, Design wheel load, contact pressure, ESWL concept and determination of ESWL by equivalent deflection criteria-problems on above.

Rigid pavements: Principle-factors affecting design-wheel load repetition and fatigue, subgrade, properties, concept of radius of relative stiffness, Westergaard's analysis, Modified Westergaard's equations, wheel load stresses, warping stresses-problems on above.

**08 Hours**

### UNIT III

**Design of Flexible Pavements**

Assumptions, design of flexible pavements by IRC: 37-2012, mechanistic analysis, service life and damage index, McLeod method, Tri-axial method- problems on above.

**08 Hours**

### UNIT IV

**Design of Rigid Pavements**

Design of CC pavements by IRC: 58-2011 methods, thickness design, damage computation for fatigue, use of PCA charts, joints, types, requirements, design of joints-problems on above.

**08 Hours**

## UNIT V

**Failures and Maintenance of Pavements**

Flexible pavements: Types of failures, causes, visual inspections for functional evaluation, unevenness, Benkelman Beam Deflection method, falling weight deflectometer.

Rigid pavements: Types of failures, causes, routine maintenance works, Functional evaluation by visual inspection and unevenness measurements, design factors for runway pavements.

**08 Hours**

**Self-Learning Topics:** Types of failures, case studies

**Text Books**

1. Highway Engineering-S K Khanna, C E G Justo and A Veeraragavan, Nem Chand Bros, Roorkee.
2. Principles & Practices of Highway Engineering-L R Kadiyali & N B Lal, Khanna Publishers, New Delhi.
3. Relevent IRC codes

**Reference Books:**

1. Principles of Pavement Design-Subha Rao.
2. Principles of Pavement Design-Yoder and Witzack-2nd edition, John Wiley's and Sons

**Course Outcome (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1 | To **explain** the characteristic features of flexible pavements and rigid pavements. | L2 |
| 2 | To **outline** design fundamentals of flexible pavements and rigid pavements. | L2 |
| 3 | To **compare** different design methods and **design** the flexible pavements. | L2, L6 |
| 4 | To **design** the rigid pavements | L6 |
| **5** | To **analyze** the failures, causes and maintenance works of flexible and rigid pavements. | L4 |

**Program Outcome (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO 1** |
| 2 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues. | **PO 3** |
| 3 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO 5** |
| 4 | Graduates shall be able to understand contemporary societal issues to address them professionally. | **PO 6** |
| 5 | Graduates shall possess effective oral and written communication skills | **PO 10** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. Power-point Presentation | 2. Quizzes |
| 3. Videos | 3. Internal Assessment Tests |
| 4. NPTEL / Edusat | 4. Semester End Examination (SEE) |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| ➢ Two IA tests are compulsory.<br>➢ **Minimum marks required to qualify for SEE : 20** | | | | | |

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## DESIGN OF PRESTRESSED CONCRETE STRUCTURES

| | | | |
|---|---|---|---|
| **Subject Code:** | 16CV757 | **Credits:** | 03 |
| **Course Type:** | PE | **CIE Marks:** | 50 |
| **Hours/week: L – T – P** | 3-0-0 | **SEE Marks:** | 50 |
| **Total Hours:** | 40 | **SEE Duration:** | 3 Hours for 100 Marks |

**Course Learning Objectives (CLOs)**

**1:** Understand the materials, principles and techniques of prestressing and analyze the PSC sections under transfer and working conditions.
**2:** Determine the losses in PSC sections due to various factors.
**3:** Estimate the deflections in PSC sections due to various factors.
**4:** Estimate the ultimate flexural strength and shear strength of PSC sections.
**5:** Design the sections to determine the prestressing force and the cable profile required.

**Pre-requisites:**

1. Analysis of Determinate and Indeterminate Structures
2. Design of RC structures

### UNIT I

**Basic principles and Flexural analysis of PSC sections**

High Strength Concrete and Steel, Principles of prestressing, Pre-tensioning and Post-tensioning systems, Stresses in PSC due to prestress and applied loads for different cable profiles, Load-Balancing concept, Pressure-Line concept, Numerical examples on the above

**08 Hours**

**Self Learning Topic:** Pressure-Line concept

## UNIT II

**Losses in PSC sections**

Losses encountered in Pre-tensioning and Post-tensioning methods, Numerical examples on the evaluation of losses and jacking force

**08 Hours**

## UNIT III

**Deflections in PSC sections**

Deflections in PSC sections, Short-term and Long-term deflections, Elastic deflections under transfer loads for different cable profiles, Deflections limits as per IS:1343-1980, Methods of controlling deflection, Numerical examples on the evaluation of deflections

**08 Hours**

## UNIT IV

**Limit State of Collapse (Flexure & Shear)**

Flexure and Shear- IS code recommendations as per IS:1343-1980, Numerical examples on determination of Ultimate flexural strength and shear strength of PSC sections (rectangular and I-sections only), Design of shear reinforcement

**08 Hours**

## UNIT V

**Design of PSC Sections**

Expressions for prestressing force, eccentricity and minimum section modulus, Design of pre-tensioned and post-tensioned PSC sections (rectangular and I-sections only) to determine the prestressing force, eccentricity, cable profile

**End Blocks in PSC**

Fundamentals and Design concepts of End blocks in PSC

**08 Hours**

**Self Learning Topic:** Fundamentals and Design concepts of End blocks in PSC

**Text books:**


1. Krishna Raju N, 'Prestressed Concrete', Tata McGraw Hill, New Delhi
2. Rajagopalan N, 'Prestressed Concrete ', Narosa Publishing House, New Delhi


**Reference books:**


1. Lin T Y and Burns N H, 'Design of Prestressed Concrete Structures', John Wiley and Sons, New York
2. Pandit G S and Gupta S P, "Prestressed Concrete", C B S Publishers, New Delhi


### Course Outcomes (COs)

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1 | **Understand** the basic principles and **apply** the techniques used for prestressing to **analyze** PSC sections under different cable profiles | **L2 L3 L5** |
| 2 | **Estimate** the losses occurring in PSC sections | **L4** |
| 3 | **Estimate** the deflections occurring in PSC sections | **L4** |
| 4 | **Evaluate** the flexural and shear strength of PSC sections | **L5** |
| **5** | **Design** the pre-tensioned and post-tensioned sections. | **L6** |

### Program Outcomes (POs)

| | | |
|---|---|---|
| **1** | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering | **PO1** |

| | | |
|---|---|---|
| **2** | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures | **PO5** |
| **3** | An ability to use the techniques, skills and modern engineering tools necessary for engineering practice | **PO11** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

**Course delivery methods**

1. Lecture and Board
2. Power-point Presentation
3. Videos
4. NPTEL / Edusat

**Assessment methods**

1. Assignments and Open Book Tests
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination (SEE)

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

## CONSTRUCTION PROJECT MANAGEMENT

| | | | |
|---|---|---|---|
| **Course Code** | 16CV758 | **Credits** | 03 |
| **Course type** | PE | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3-0-0 | **SEE Marks** | 50 |
| **Total Hours** | 40 | **SEE Duration** | 3 Hours for 100 Marks |

**Course learning objectives (CLOs)**

1. Understand about project management process and its significance
2. Explain the structure of Construction Company and scheduling of various activities
3. Analyze and formulate different techniques of scheduling.
4. Estimate the construction cost for a project
5. Understand resource planning and significance of management in resource planning
6. Understand Quality Management Systems, Total Quality Management, Construction safety and its importance

**Pre-requisites:**

1. Management and Entrepreneurship

## UNIT I

**Introduction**

Introduction – Project definition, concept, features; construction project management processes Initiating, Planning, Executing, Controlling; construction project manager – role, competency skills; Project Integration Management - Project plan development, Project plan execution; Project management knowledge areas; Causes for project failure; Scenario of Indian construction industry – need of construction management

**08 Hours**

**Self Learning Topics:** Scenario of Indian construction industry – need of construction management.

## UNIT II

**Project planning and time estimate**

Construction company structure; Project charter, structure; Activity sequencing – scheduling logic, diagramming method; estimating activity duration Activity definition - work breakdown precedence diagramming method, arrow

**08 Hours**

## UNIT III

**Network Analysis**

CPM-Critical Path Method, PERT-Program Evaluation and Review Technique; Precedence Network Analysis; line-of-balance method, Scheduling – fundamentals of work scheduling, bar chart method, schedule control

**08 Hours**

**Self Learning Topics: Schedule control.**

## UNIT IV

**Resource planning and construction cost**

Introduction to 4M's; Manpower planning; Material Planning; Machinery Planning; Money Planning. Role & function of Construction Managers in improving resources productivity; Resource planning. Methods of estimating Project costs (introduction); Classification of construction costs; breakeven point analysis; Earned Value Management.

**08 Hours**

## UNIT V

**Construction quality and safety**

Introduction to Quality Management System in Civil Engineering ISO 9001:2015 - Quality, Inspection (Checklists), Quality control, Quality Assurance; Quality Certification for companies), Introduction to Total Quality Management, Construction Safety-meaning and scope, Causes of Accidents on various sites, safety measures and safety policies to be adopted, determination of safety parameters, personal protective equipment. Workmen Compensation Act.

**08 Hours**

**Text books:**


1. K.K.Chitkara, **"Construction Project Management"**, Tata McGraw Hill
2. S. W. Nunnally, Pearson, **"Construction Methods and Management"**
3. Ds Rajendraprasad, **"Quality Management System in Civil Engineering"**, ISO9001-2008.


**Reference books**:


1 **"PMBOK- A Guide to the Project Management Body of Knowledge"**, Project Management Institute, Inc.

2 Jens J. Dahlgaard, Kai Kristensen, Gopal K. Kanji, **"Fundamentals of Total Quality Management"**, Taylor and Francis

3 Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, **"Construction Planning, Equipment, and Methods"**, Mc Graw Hill.
**4** OHSAS 18001 Occupational Health and Safety Zone.
1. Abdul Razzak Rumane, CRC Press- Taylor and Francis**. "Quality Management in Construction Projects"**,

**Course Outcomes (COs)**

| | **At the end of the course, students will be able to** | **Bloom's Level** |
|---|---|---|
| 1. | **Understand** and **explain** the project management process and Its significance. | **L2** |
| 2. | **Understand** the structure of a construction company and **develop** the schedules for various activities | **L2, L6** |
| 3. | **Estimate** various construction costs**.** | **L5** |
| 4. | **Explain** QMS, TQM and safety at construction sites | **L2** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall possess the ability to review the research literature and analyze complex engineering problems. | **PO1** |
| 2 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues | **PO7** |
| 3 | Graduates shall be able to understand contemporary societal issues to address them professionally | **PO6** |
| 4 | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability | **PO7** |
| 5 | Graduates shall learn to apply the principals of engineering and management in multidisciplinary environment | **PO11** |
| 6 | Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth. | **PO12** |

**Content Delivery/Assessments methods and Scheme of Evaluation**

| **Course delivery methods** | **Assessment methods** |
|---|---|
| 1. Lecture and Board | 1. Assignments and Open Book Tests |
| 2. Power-point Presentation | 2. Quizzes |
| 3. Videos | 3. Internal Assessment Tests |
| 4. NPTEL / Edusat | 4. Semester End Examination (SEE) |

**Scheme of Continuous Internal Evaluation (CIE)**

| Components | Average of best two IA tests out of three | **Average of assignments (Two) / activity** | **Quiz** | Class participation | Total Marks |
|---|---|---|---|---|---|
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |

- Two IA tests are compulsory.
- **Minimum marks required to qualify for SEE : 20**

**Scheme of Semester End Examination (SEE)**

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass:40 (out of 100 )**
3. Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

**STRUCTURAL STEEL DESIGN AND DRAWING LABORATORY**

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL76 | **Credits:** | 03 |
| **Course Type** | PC | **CIE Marks:** | 50 |
| **Hrs/Week: L:T: P:** | 1-0-4 | **SEE Marks:** | 50 |
| **Total Hours:** | 50 | **SEE Duration:** | 4 Hrs. |

**Course Learning Objectives (CLOs)**

1. Acquaint students with the basic principles and draw bolted and welded connections.
2. Acquaint students with the basic principles and draw draw splices built-up columns and bases.
3. Design and draw plan, sectional elevation and cross-section of plate girders, gantry girders and trusses.

**Pre-requisites:**

1. Design of Steel Structures

**PART - A**

(DRAWING TO BE PREPARED FOR GIVEN STRUCTURAL DETAILS)

1. **Connections:** Drawing of Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened connections
2. **Columns:** Splices, Columns, Built-up Columns, Built-up Laced and batten Columns.
3. **Column bases:** Slab base and gusseted base.

**13(T) + 18(D)**

**PART – B**

4. **Design and drawing of -**
   a. Welded plate girder
   b. Design and drawing of Gantry girder
   c. Roof Truss (Forces in the members to be given)

**13(T) + 21(D)**

**Reference Books**


1. Ramachandra, "Design Steel Structures', Volume II, Scientific Publisher 9th edition, 2012 ISBN 978-81-7233644-8
2. Subramanian N, "Design Steel Structures' Oxford University press
3. Duggal S. K, "Limit State Design of Steel Structures" Tata McGraw-Hill Education Private Ltd, 2010 ISBN 9780070700239
4. Bhavikatti SS Design Steel Structures' 1 K International Publishing House Pvt Ltd ISBN 978-93-80026-61-9
5. BIS Codes

a.IS800-2007, General Construction steel code of Practice
b. IS875-1987, Code of Practice for Design Loads
c.SP6 (I)-1964, Hand Book for structural Engineers- Structural steel section
d. Design Hand Book of Open Web Structures CMERI, Durgapur

**Course Outcomes (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1 | Draw Welded and Bolted Connections | **L4** |
| 2 | Draw Built-up Columns and Splices | **L4** |
| 3 | Draw Splices, Slab base and gusseted bases | **L4** |
| 4 | Design and Draw Plate Girders, Gantry Girders and Trusses | **L5** |

**Scheme of Continuous Internal Evaluation**:
CIE consists of one test each for 25 marks. 10 Marks for Quiz +10 marks for performance. In-addition there will be one seminar/project on new topics/ filed visits etc for 05 Marks

**Content Delivery/Assessments methods and Scheme of Evaluation**

| Course delivery methods | Assessment methods |
|---|---|
| 1. Lecture and Board | 1. Assignments |
| 3. Videos | 2. Quizzes |
| 4. NPTEL / Edusat | 3. Internal Assessment Tests |
| | 4. Semester End Examination (SEE) |

**Scheme of Semester End Examination:**
The question paper consists of Part A and Part B; Part A will be for 40 marks. Part B will be for 60 Marks and shall consist of one question on design and drawing.

## GEOTECHNICAL ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL77 | **Credits** | 01 |
| **Course type** | PC | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 0-0-2 | **SEE Marks** | 25 |
| **Total Hours:** | 26 | **SEE Duration** | 3Hours |

**Course learning objectives (CLOs)**

1. To **determine** of index properties of soil
2. To **determine** of engineering properties of soil

**Pre-requisites:**

1. Soil Mechanics
2. Strength of materials

**List of Experiments:**

| | |
|---|---|
| **1** | Determination of Water content (Oven drying method) and Specific gravity (for coarse and fine grained soils) |
| **2** | Determination of Grain size distribution of soil by Sieve analysis |
| **3** | Determination of In situ density by core cutter and sand replacement methods. |
| **4** | Determination of Consistency Limits – Liquid Limit (Casagrande Method), plastic limit and shrinkage limit. |
| **5** | Determination of Compaction properties of soil by Standard Proctor Compaction test |
| 6 | Determination of Coefficient of permeability by constant head and variable head methods |
| **7** | Determination of Shear parameters by-<br>a. Unconfined Compression Test<br>b. Direct Shear Test for cohesive and cohesionless soils<br>c. Laboratory vane shear test |
| **8** | Demonstrations<br>a. Demonstration of miscellaneous equipments such as Augers, Samplers, Rapid Moisturemeter, Proctor's needle, Hydrometer, Relative density.<br>b. Demonstration of Free swell and Differential free swell tests<br>d. Demonstration of Triaxial Compression Test (undrained)<br>e. Demonstration of California Bearing Ratio |

**References:**


1. Punmia. B.C (2005) "**Soil Mechanics and Foundation Engg"**, 16th Edition Laxmi Publications Co. , New Delhi.
2. **BIS Codes of Practice**: IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720(Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part –7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) –1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part –14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) –1966, IS 2720 (Part-60) 1965.
3. Lambe T.W., "**Soil Testing for Engineers"**, Wiley Eastern Ltd., New Delhi.
4. Head K.H (1986)., "**Manual of Soil Laboratory Testing"**, Vol. I, II, III, Princeton Press, London


**Course Outcomes (COs)**

| At the end of the course, students will be able to | Bloom's Level |
|---|---|
| 1. **Determine** basic properties and engineering properties of soil | L2 |
| 2. **Classify** soil by using index properties | L2, L6 |
| 3. **Identify** the suitability of soil as a construction material | L5 |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1 | Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering. | **PO5** |
| 2 | Graduates shall possess critical thinking abilities, problem solving skills and familiarity with the necessary computational tools and procedures. | **PO2** |
| 3 | Graduates shall possess effective oral and written communication skills. | **PO10** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

1. Continuous evaluation of conduct of Practical and Journals
2. Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

**Minimum CIE marks required for eligibility for SEE: 13 out of 25**

**Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50.

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |

## ENVIRONMENTAL ENGINEERING LABORATORY

| | | | |
|---|---|---|---|
| **Course Code** | 16CVL78 | **Credits** | 01 |
| **Course type** | PC | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 0-0-2 | **SEE Marks** | 25 |
| **Total Hours:** | 26 | **SEE Duration** | 3 Hours for 50 marks |

**Course Learning Objectives (CLOs)**

1. Discuss various types of sampling.
2. Examine the given water or wastewater samples for physical parameters.
3. Carryout the analysis of given sample for chemical contamination.
4. Understand the characteristics of drinking water.
5. Discuss pure water, palatable water and potable water.

| Exp. No. | Experiments |
|---|---|
| 1 | Determination of solids in sewage: Total solids, Suspended solids, Dissolved solids and Electrical conductivity |
| 2 | Determination of chlorides |
| 3 | Determination of alkalinity (alkalinity due to carbonates, bicarbonates and hydroxyls) |
| 4 | Determination of Calcium, Magnesium and Total Hardness |
| 5 | Determination of Dissolved oxygen and Determination of BOD |
| 6 | Determination of COD |
| 7 | Determination of Percentage of available chlorine in bleaching powder and chlorine demand |
| 8 | Jar test for optimum dosage of Alum, Turbidity determination by Nephelometer |
| 9 | Determination of Iron (Phenanthroline method) |
| 10 | Determination of Fluorides (SPANDS method) |
| 11 | Determination of acidity (acidity due to carbon dioxide and mineral acids) |
| 12 | Determination of pH |
| 13 | Determination Nitrates by spectrophotometer |
| 14 | Determination of Sulphates |
| 15 | Determination of Oil and Grease |

**References**


1. **"Manual of Water and Wastewater Analysis",** NEERI Publication
2. **"Standard Methods for Examination of Water and Wast ewater"** , American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC, (1995),
3. **IS Standards**: 2490-1974, 3360-1974, 3307-1974, 10500: 2012.
4. Sawyer and Mc Carthy, " **Chemistry for Environment Engineering**"
5. **"Manual on wastewater and treatment**", CPHEEO, Ministry of Urban Development, New Delhi, May 1999.


**Course Outcome (COs)**

| | At the end of the course, the student will be able to | Bloom's Level |
|---|---|---|
| 1. | **Explain** the significance of sample collection. | **L2** |
| 2. | **Identify** the water or wastewater samples for physical parameters. | **L1** |
| 3. | Conduct the experiments on water or wastewater samples, **analyse** the results and draw conclusions. | **L3** |
| 4 | **Explain** the Drinking water standards as specified by BIS and Central Pollution Control Board (CPCB) standards for discharging the wastewater into the streams | **L2** |
| 5 | **Differentiate** between pure water, palatable water and potable water | **L4** |

**Program Outcomes (POs)**

| | | |
|---|---|---|
| 1. | Graduates shall possess the ability to review the research literature and analyze complex engineering problems. | **PO 2** |
| 2 | Graduates shall possess the ability to identify and address the societal needs and meaningfully contribute, keeping in mind the health, environmental, safety and cultural issues | **PO 3** |
| 3. | Graduates shall be able to understand contemporary societal issues to address them professionally. | **PO 6** |
| 4. | Graduates shall be able to understand the impact of engineering solutions to environmental sustainability. | **PO 7** |

**Content Delivery/Assessments methods and Scheme of Evaluation:**

1 Continuous evaluation of conduct of Practical and Journals

2 Viva voce

**Scheme of Continuous Internal Evaluation (CIE)**

| Conduct of Lab | Journal submission | Total Marks |
|---|---|---|
| 10 | 15 | 25 |

**1 Minimum marks required for eligibility for SEE: 13 out of 25**

**2 Submission of Journals and certification is compulsory for eligible to SEE**

**Scheme of Semester End Examination (SEE):**

1. Lab examination will be conducted for 50 marks and scaled down to 25 marks for the calculation of SGPA and CGPA.
2. Only ONE experiment needs to be conducted; Individual viva voce shall be taken.
3. Minimum marks required in SEE to pass: 20 out of 50

| | |
|---|---|
| Initial write up | 10 marks |
| Conduct of experiment | 20 marks |
| Viva voce | 20 marks |