

# Course Structure & Curriculum

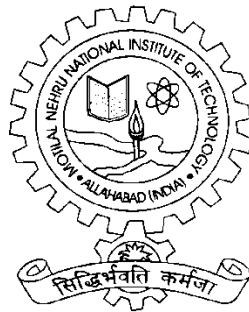
for

## B. Tech. Programme

in

## Civil Engineering

[Effective from 2017-2018]



**Department of Civil Engineering**  
**Motilal Nehru National Institute of Technology Allahabad**  
**Prayagraj -211004 (India)**

## Course Structure for B. Tech. Programme in Civil Engineering

### I-Semester

| 1 <sup>st</sup> year: I-Semester |                       |  |         |          |           |           |
|----------------------------------|-----------------------|--|---------|----------|-----------|-----------|
| S. No.                           | Code                  | Subject  | Lecture | Tutorial | Practical | Credits   |
| 1.                               | PH-11101              | Physics-I  | 3       | 1        | -         | 4         |
| 2.                               | HS-11101/<br>CS-11101 | English language and<br>Composition/ Computer<br>Programming | 2       | 1        | -         | 3         |
| 3.                               | CY-11101/<br>AM-11101 | Chemistry/<br>Engg. Mechanics                                | 3       | 1        | -         | 4         |
| 4.                               | MA-11101              | Mathematics I  | 3       | 1        | -         | 4         |
| 5.                               | ME-11101/<br>11102    | Engg. Graphics/<br>Workshop                                  | 1       | -        | 3         | 3         |
| 6.                               | HS-11102/<br>PH-11201 | Communication Skill<br>Workshop/<br>Physics (Lab)            | 2<br>-  | -<br>-   | -<br>3    | 2         |
| 7.                               | CY-11201/<br>AM-11201 | Chemistry (Lab)/<br>Engg. Mechanics (Lab)                    | -       | -        | 3         | 2         |
| 8.                               | HS-11201/<br>CS-11201 | Language Lab/<br>Computer Programming (Lab)                  | -       | -        | 3         | 2         |
| <b>Total</b>                     |                       |  |         |          |           | <b>24</b> |

### II-Semester

| 1 <sup>st</sup> year: II-Semester |                       |   |         |          |           |           |
|-----------------------------------|-----------------------|---|---------|----------|-----------|-----------|
| S. No.                            | Code                  | Subject   | Lecture | Tutorial | Practical | Credits   |
| 1.                                | PH-12102              | Physics-I   | 3       | 1        | -         | 4         |
| 2.                                | HS-12101/<br>CS-12101 | English language and Composition/<br>Computer Programming | 2       | 1        | -         | 3         |
| 3.                                | CY-12101/<br>AM-12101 | Chemistry/<br>Engg. Mechanics                             | 3       | 1        | -         | 4         |
| 4.                                | MA-12101              | Mathematics I   | 3       | 1        | -         | 4         |
| 5.                                | ME-12101/<br>12102    | Engg. Graphics/<br>Workshop                               | 1       | -        | 3         | 3         |
| 6.                                | CE 12101              | Environment & Climate Change                              | 2       | -        | -         | 2         |
| 7.                                | HS-12102/<br>PH-12201 | Communication Skill Workshop/<br>Physics (Lab)            | 2<br>-  | -<br>-   | -<br>3    | 2         |
| 8.                                | CY-12201/<br>AM-12201 | Chemistry (Lab)/<br>Engg. Mechanics (Lab)                 | -       | -        | 3         | 2         |
| 9.                                | HS-12201/<br>CS-12201 | Language Lab/<br>Computer Programming (Lab)               | -       | -        | 3         | 2         |
| <b>Total</b>                      |                       |   |         |          |           | <b>26</b> |

**Course Structure for B. Tech. Programme in Civil Engineering**

**III-Semester**

| S. No. | Code     | Subject                                   | L         | T        | P         | Credits   |
|--------|----------|---|-----------|----------|-----------|-----------|
| 1.     | CE-13101 | Building Planning & Construction          | 2         | ---      | ---       | 2         |
| 2.     | CE-13102 | Computer Based Numerical Techniques       | 3         | ---      | ---       | 3         |
| 3.     | CE-13103 | Engineering Geology                       | 2         | ---      | ---       | 2         |
| 4.     | CE-13201 | Building Planning & Construction (Lab.)   | ---       | ---      | 3         | 2         |
| 5.     | CE-13202 | Computer Based Numerical Techniques(Lab.) | ---       | ---      | 3         | 2         |
| 6.     | CE-13203 | Engineering Geology (Lab.)                | ---       | ---      | 3         | 2         |
| 7.     | AM-13101 | Fluid Mechanics – I                       | 3         | 1        | ---       | 4         |
| 8.     | AM-13104 | Strength of Materials                     | 3         | 1        | ---       | 4         |
| 9.     | AM-13201 | Fluid Mechanics – I(Lab.)                 | ---       | ---      | 3         | 2         |
| 10.    | AM-13204 | Strength of Materials (Lab.)              | ---       | ---      | 3         | 2         |
|        |          | <b>Total</b>                              | <b>13</b> | <b>2</b> | <b>15</b> | <b>25</b> |

**IV-Semester**

| S. No. | Code     | Subject  | L         | T        | P        | Credits   |
|--------|----------|--|-----------|----------|----------|-----------|
| 1.     | CE-14101 | Building Materials & Concrete Technology           | 3         | ---      | ---      | 3         |
| 2.     | CE-14102 | Surveying  | 3         | 1        | ---      | 4         |
| 3.     | CE-14103 | Estimating, Costing & Valuation                    | 3         | 1        | ---      | 4         |
| 4.     | CE-14201 | Building Materials & Concrete Technology<br>(Lab.) | ---       | ---      | 3        | 2         |
| 5.     | CE-14202 | Surveying (Lab.)                                   | ---       | ---      | 3        | 2         |
| 6.     | AM-14104 | Structural Analysis – I                            | 3         | 1        | ---      | 4         |
| 7.     | AM-14105 | Fluid Mechanics – II                               | 3         | 1        | ---      | 4         |
| 8.     | HS-14101 | Principles of Management                           | 3         | ---      | ---      | 3         |
| 9.     | AM-14205 | Fluid Mechanics – II (Lab.)                        | ---       | ---      | 3        | 2         |
|        |          | <b>Total</b>                                       | <b>18</b> | <b>4</b> | <b>9</b> | <b>28</b> |

**Course Structure for B. Tech. Programme in Civil Engineering**

**V-Semester**

| S. No. | Code     | Subject                               | L         | T        | P        | Credits   |
|--------|----------|---------------------------------------|-----------|----------|----------|-----------|
| 1.     | CE-15101 | Geotechnical Engineering – I          | 3         | 1        | ---      | 4         |
| 2.     | CE-15102 | Transportation Engineering - I        | 3         | 1        | ---      | 4         |
| 3.     | CE-15103 | Concrete Structures – I               | 3         | 1        | ---      | 4         |
| 4.     | CE-15104 | Environmental Engineering - I         | 3         | 1        | ---      | 4         |
| 5.     | CE-15105 | Geoinformatics                        | 3         | 1        | ---      | 4         |
| 6.     | CE-15201 | Geotechnical Engineering – I (Lab.)   | --        | ---      | 3        | 2         |
| 7.     | CE-15202 | Transportation Engineering – I (Lab.) | ---       | ---      | 3        | 2         |
| 8.     | AM-15101 | Structural Analysis – II              | 3         | 1        | ---      | 4         |
| 9.     | AM-15201 | Structural Analysis – II (Lab.)       | ---       | ---      | 3        | 2         |
|        |          | <b>Total</b>                          | <b>18</b> | <b>6</b> | <b>9</b> | <b>30</b> |

**VI-Semester**

| S. No. | Code     | Subject                               | L                    | T        | P         | Credits   |
|--------|----------|---------------------------------------|----------------------|----------|-----------|-----------|
| 1.     | CE-16101 | Concrete Structures - II              | 3                    | 1        | ---       | 4         |
| 2.     | CE-16102 | Environmental Engineering - II        | 3                    | 1        | ---       | 4         |
| 3.     | CE-16103 | Geotechnical Engineering - II         | 3                    | 1        | ---       | 4         |
| 4.     | CE-16104 | Transportation Engineering - II       | 3                    | 1        | ---       | 4         |
| 5.     | CE-16201 | Concrete Structures – II (Lab.)       | ---                  | ---      | 3         | 2         |
| 6.     | CE-16202 | Environmental Engineering – II (Lab.) | ---                  | ---      | 3         | 2         |
| 7.     | CE-16203 | Geotechnical Engineering – II (Lab.)  | ---                  | ---      | 3         | 2         |
| 8.     | CE-16205 | Computer Aided Design (Civil) (Lab.)  | ---                  | ---      | 3         | 2         |
| 9.     | CE-16206 | Survey Camp                           | Two weeks field work |          |           | 4         |
|        |          | <b>Total</b>                          | <b>12</b>            | <b>4</b> | <b>12</b> | <b>28</b> |

**Course Structure for B. Tech. Programme in Civil Engineering**

**VII-Semester**

| S. No.       | Code                 | Subject                            | L         | T        | P        | Credits   |
|--------------|----------------------|------------------------------------|-----------|----------|----------|-----------|
| 1.           | CE-17101             | Steel Structures                   | 3         | ---      | ---      | 3         |
| 2.           | CE-17102             | Construction Planning & Management | 3         | ---      | ---      | 3         |
| 3.           | CE-17103             | Water Resources Engineering - I    | 3         | ---      | ---      | 3         |
| 4.           | CE-17201             | Steel Structures Detailing (Lab.)  | ---       | ---      | 3        | 2         |
| 5.           | CE-17301 to CE-17310 | Professional Elective – I          | 3         | 1        | ---      | 4         |
| 6.           | CE-17501 to CE-17504 | Open Elective - I                  | 3         | ---      | ---      | 3         |
| 7.           | CE-17601             | Project                            | ---       | 4        | ---      | 4         |
| <b>Total</b> |                      |                                    | <b>15</b> | <b>5</b> | <b>3</b> | <b>22</b> |

**VIII-Semester**

| S. No        | Code                 | Subject                          | L         | T         | P          | Credits   |
|--------------|----------------------|----------------------------------|-----------|-----------|------------|-----------|
| 1.           | CE-18101             | Earthquake Resistant Design      | 3         | 1         | ---        | 4         |
| 2.           | CE-18102             | Water Resources Engineering - II | 3         | 1         | ---        | 4         |
| 3.           | CE-18301 to CE-18310 | Professional Elective – II       | 3         | 1         | ---        | 4         |
| 4.           | CE-18401 to CE-18410 | Professional Elective – III      | 3         | 1         | ---        | 4         |
| 5.           | CE-18501 to CE-18505 | Open Elective – II               | 3         | ---       | ---        | 3         |
| 6.           | CE-18601             | Project                          | ----      | 8         | ---        | 8         |
| <b>Total</b> |                      |                                  | <b>15</b> | <b>12</b> | <b>---</b> | <b>27</b> |

**Total Course Credits = 24+26+ 25+28+ 30+28+ 22+27 = 210**

## LIST OF PROFESSIONAL ELECTIVES

### VII-Semester

#### Professional Elective – I

| S. No. | Code     | Subject                                      | L | T | P   | Credit |
|--------|----------|--|---|---|-----|--------|
| 1.     | CE-17301 | Advanced Concrete Technology                 | 3 | 1 | --- | 4      |
| 2.     | CE-17302 | Bridge Engineering                           | 3 | 1 | --- | 4      |
| 3.     | CE-17303 | Finite Element and Finite Difference Methods | 3 | 1 | --- | 4      |
| 4.     | CE-17304 | Structural Dynamics                          | 3 | 1 | --- | 4      |
| 5.     | CE-17305 | Rock Engineering                             | 3 | 1 | --- | 4      |
| 6.     | CE-17306 | Advanced Wastewater Treatment                | 3 | 1 | --- | 4      |
| 7.     | CE-17307 | Design of Water Supply and Treatment Systems | 3 | 1 | --- | 4      |
| 8.     | CE-17308 | Traffic Engineering                          | 3 | 1 | --- | 4      |
| 9.     | CE-17309 | Transportation System and Planning           | 3 | 1 | --- | 4      |
| 10.    | CE-17310 | Engineering Hydrology                        | 3 | 1 | --- | 4      |

### VIII-Semester

#### Professional Elective – II

| S. No. | Code     | Subject  | L | T | P   | Credit |
|--------|----------|--|---|---|-----|--------|
| 1.     | CE-18301 | Advanced Concrete Design                           | 3 | 1 | --- | 4      |
| 2.     | CE-18302 | Construction Equipment and Techniques              | 3 | 1 | --- | 4      |
| 3.     | CE-18303 | Plastic Design of Steel Structures                 | 3 | 1 | --- | 4      |
| 4.     | CE-18304 | Advanced Foundation Design                         | 3 | 1 | --- | 4      |
| 5.     | CE-18305 | Soil Dynamics                                      | 3 | 1 | --- | 4      |
| 6.     | CE-18306 | Air Pollution & Control                            | 3 | 1 | --- | 4      |
| 7.     | CE-18307 | Design of Waste Water System                       | 3 | 1 | --- | 4      |
| 8.     | CE-18308 | Rural Roads  | 3 | 1 | --- | 4      |
| 9.     | CE-18309 | Open Channel Hydraulics                            | 3 | 1 | --- | 4      |
| 10.    | CE-18310 | Advanced Geological and Geophysical Investigations | 3 | 1 | --- | 4      |

### Professional Elective – III

| S. No. | Code      | Subject                                    | L | T | P   | Credit |
|--------|-----------|--|---|---|-----|--------|
| 1.     | CE-18401  | Matrix Analysis of Structures              | 3 | 1 | --- | 4      |
| 2.     | CE-18402  | Precast and Modular Construction Practices |   |   |     |        |
| 3.     | CE-18403  | Prestressed Concrete                       | 3 | 1 | --- | 4      |
| 4.     | CE-18404  | Earth and Earth Retaining Structures       | 3 | 1 | --- | 4      |
| 5.     | CE-18405  | Geotechnical Processes                     | 3 | 1 | --- | 4      |
| 6.     | CE -18406 | Rural Water Supply and Sanitation          | 3 | 1 | --- | 4      |
| 7.     | CE-18407  | Solid Waste Management                     | 3 | 1 | --- | 4      |
| 8.     | CE-18408  | Transport Asset Management                 | 3 | 1 | --- | 4      |
| 9.     | CE-18409  | Water Resources Systems Management         | 3 | 1 | --- | 4      |
| 10.    | CE-18410  | Remote Sensing in Civil Engineering        | 3 | 1 | --- | 4      |

### LIST OF OPEN ELECTIVES

#### VII-Semester [Open Elective -I]

| S. No. | Code     | Subject Name                    | L | T   | P   | Credit |
|--------|----------|---------------------------------|---|-----|-----|--------|
| 1.     | CE-17501 | Waste Material Management       | 3 | --- | --- | 3      |
| 2.     | CE-17502 | Environmental Impact Assessment | 3 | --- | --- | 3      |
| 3.     | CE-17503 | Elements of Civil Engineering   | 3 | --- | --- | 3      |
| 4.     | CE-17504 | Elements of Remote Sensing      | 3 | --- | --- | 3      |

#### VIII-Semester [Open Elective -II]

| S. No. | Code     | Subject Name  | L | T   | P   | Credits |
|--------|----------|---|---|-----|-----|---------|
| 1.     | CE-18501 | Fundamentals of GIS & GPS                           | 3 | --- | --- | 3       |
| 2.     | CE-18502 | Water Resources Management                          | 3 | --- | --- | 3       |
| 3.     | CE-18503 | Regional and Urban Planning                         | 3 | --- | --- | 3       |
| 4.     | CE-18504 | Operations Research                                 | 3 | --- | --- | 3       |
| 5.     | CE-18505 | Unmanned Aerial Vehicle (UAV) and Their Application | 3 | --- | --- | 3       |

## B. TECH. -II SEMESTER

### ENVIRONMENT AND CLIMATE CHANGE

**CE-12101**

**CREDIT 02**

**2-0-0**

**UNIT 1. Introduction**

**04(L)**

Introduction to Environmental challenges, Natural Resources conservation concepts and techniques, Indian Natural Resource Management Programmes and its objectives.

**UNIT 2. Sustainable Development**

**04(L)**

Sustainable Development, Carrying capacity based development, clean energy alternatives on various segments and its application with case studies.

**UNIT 3. Climate Change-I**

**04(L)**

Climate change challenges, Cause and Impact Assessment Studies for climate changes and mitigation measures for reversal of climate changes. Technological interventions alternatives and case studies.

**UNIT 4. Climate Change-II**

**04(L)**

International agenda and treaties for climate changes. Global concerns and efforts to minimise climate change impact on society.

**UNIT 5. Environmental Impact Assessment**

**04(L)**

Social and Environmental Impact assessment. International treaties & Global initiatives related to Environment and climate change, Carbon foot print.

**UNIT 6. Pollution and Environmental Laws**

**04(L)**

Preventive measures to control airwater, soil and noise pollution and related national or international standards, Environmental Laws and regulations.

**References:**

1. *A Basic Course in Environmental Studies. Deswal & Deswal. Pub. Dhanpat Rai & Sons*
2. *Environmental Studies. Bharucha. Pub. University of Press*
3. *Ecology. Odum. Pub. Oxford & IBH*
4. *Environmental Engineering. Peany et.al. Pub. McGraw Hill*
5. *A Text Book of Environmental Engg. Venugpal Rao. Pub. PHI*



## B. TECH. -III SEMESTER

### BUILDING PLANNING & CONSTRUCTION

CE-13101

CREDIT 02

2-0-0

#### UNIT 1. Building Byelaws & Development Controls

03(L)

Types of buildings, Concept of functional efficiency of buildings, Recommendations of NBC 2005 for building planning. FSI and FAR restrictions. Green rating of Buildings. Oriental principles of building planning.

#### UNIT 2. Building Science

04(L)

Thermal and acoustic behavior of buildings and associated design computations. Lighting in building. Active and passive means of improving functional performance of buildings. Energy Efficient Built environment.

#### UNIT 3. Building Components & Construction Details

05(L)

Components of building and area considerations, Damp proofing anti- termite treatment. Planning, design and construction of vertical circulation means. Different types of floors, and roofs. Roof treatments for thermal insulation and water proofing. Different types of doors, windows & ventilators. Classification, Defects and properties of timber. Seasoning and preservation of timber.

#### UNIT 4. Masonry Construction

05(L)

Masonry construction using stones, bricks and other building blocks. Specifications for building stone, commonly used stones in masonry construction. Testing and preservation of stones. Manufacturing of clay bricks and their classification, Properties of clay bricks and their testing, Problems of efflorescence and lime bursting in bricks and tiles. Bonds in masonry construction .Different types of mortars used in masonry construction. Factors affecting strength of masonry. Cavity wall, hollow block construction, Fal G bricks and other green construction building blocks.

#### UNIT 5. Planning for Building Services

04(L)

Water supply and sanitary fittings (Plumbing), Fire safety installations, electricity. Heating ventilation & air-conditioning, mechanical lifts and escalators.

#### UNIT 6. Building Finishes and Maintenance

04(L)

Plastering, pointing, Distempering, Color washing, and Painting. Polymers, Plastic, Paints and Varnishes. Glass and insulating materials. Preventive maintenance Principles & Methods. Useful life of buildings.

#### References:

1. S.K. Sharma: *A Text Book of Building Construction*, S. Chand & Company Ltd.
2. B.C. Punmia : *A Text Book of Building Construction*, Laxmi Publications, Delhi.
3. O.H. Koenisberger: “*Manual of tropical housing and building*”, Orient Longman Ltd., Madras.
4. S.P. Arora et al., “*A Text Book of Building Construction (Planning Techniques and Methods of construction)* - Dhanpat Rai & Sons, Delhi.
5. TERI *Guide to Sustainable Building Design*, TERI, New Delhi

## COMPUTER BASED NUMERICAL TECHNIQUES

**CE-13102**

**CREDIT: 03**

**3-0-0**

**UNIT 1. General Considerations**

**04(L)**

Introduction to numerical analysis, its concepts & mathematical preliminaries

**UNIT 2. Errors and Their Analysis**

**06(L)**

Sources of Errors, Accuracy of Numbers, Type of Errors, Errors in Numerical Computations, Arithmetic Operation with Normalized Floating Point Numbers.

**UNIT 3. Algebraic & Trancedental Equation**

**10(L)**

Bisection Method, Iteration Method, Muller's Method, Method of False Position, Newton-Raphson Method.

**UNIT 4. Interpolation**

**06(L)**

Introduction of Finite Differences, Decision of Errors, Newton's formulae for Interpolation, Gauss, Interpolation by Unevenly Spaced Points, Lagrange Interpolation Formula, Newton Divided Difference Formula

**UNIT 5. Numerical Integration and Differentiation**

**08(L)**

Introduction of Numerical differentiation and Numerical Integration, Trapezoidal Rule, Simpson 1/3 rule, Simpson 3/8 Rule, Booles and Weddles rule, Gaussian formula.

**UNIT 6. Statistical Computation**

**06(L)**

Frequency Distribution & Chart, Method of Least Square, Fitting a Straight Line, Exponential curve fit, Regression analysis, Least Square fit, Polynomial fit, Linear & Non Linear Regression, Multiple Regression, Statistical Quality Control Methods.

**References:**

1. Manish Goyal, *Computer-Based Numerical & Statistical Techniques*, Laxmi Publications, New Delhi, 2008.
2. Jain, lyengar, Jain, *Numerical Methods for Scientific & Engineering computation*, New Age International
3. Balaguruswamy, *Numerical Methods*, TMH
4. Sastry, *Introductory Method of Numerical Analysis*, PHI
5. Gerald & Wheatley, *Applied Numerical Analysis*, Addison Wesley
6. Hulquit, *Numerical Method for Engineers & Computer Scientist?*, Addison Wesley
7. Flowers, *Numerical Methods In C++*, Oxford University Press
8. Vedamurthy, *Numerical Methods*, Vikas

## ENGINEERING GEOLOGY

CE- 13103

CREDIT: 2

2 0 0

### UNIT 1. Minerals and Rocks

06(L)

Minerals: Their physical properties and study of certain rock forming minerals. Rocks: origin, structure, Texture and classification of igneous, sedimentary and metamorphic rocks and their suitability as engineering materials.

### UNIT 2. Structural Geology

06(L)

Stratification, Lamination, Bedding, Outcrop-its relation to topography, dip and strike of bed, overlap, outlier and inlier, Rock deformation: Folds, Faults, joints unconformity and their classification.

### UNIT 3. Earthquake

02(L)

Earthquake, its causes, classification, seismic zones of India and Geological consideration for construction of building and other projects in seismic areas.

### UNIT 4. Landslide and Ground Water Harvesting

04(L)

Landslides, its causes, classification and preventive measures, Ground water and rainwater harvesting, Ground water provinces of India.

### UNIT 5. Engineering Materials

02(L)

Building Stones, Engineering properties of rocks, Alkali aggregate reaction, Grouting, Pozzolonic materials.

### UNIT 6. Geological Investigation

06(L)

Geological investigations for site selection of Dams and reservoirs tunnels, bridges and Highways, Principles of Geophysical explorations methods for subsurface structures.

### References:

1. *P.K. Mukerjee: A Text Book of Geology, Calcutta Word Publishers.*
2. *K V G K Gokhale: Principles of Engineering Geology, B.S. Publications.*
3. *D.S. Arora: Geology for Engineers, Mohindra Capital Publishers, Chandigarh.*
4. *J.M. Treteth: Geology of Engineers, Princeton, Von. Nostrand.*
5. *Prabin Singh: Engg. and General Geology, Katson Publishing House.*
6. *F.G.M. Blyth: A Geology for Engineers, Arnold, London.*
7. *R.F. Leggot: Geology and Engineering, McGraw Hill, New York.*

**BUILDING PLANNING & CONSTRUCTION (LAB.)**

**CE-13201**

**CREDIT 02**

**0-0-3**

**List of Practical:**

1. Preparation of Drawings by students:
  - (i) Details of Bonds in Brick Masonry and Stone Masonry
  - (ii) Planning of a building with given site conditions.
  - (iii) Details of different types of Staircase and a section through foundation and super structure.
  - (iv) Details of commonly used Doors and Windows.
  - (v) Details of Single Stack and Double Stack Plumbing system.
  - (vi) Development of drawings for Planning of a building with given site conditions on Auto Cad.
  - (vii) Details of earthquake resistant provisions in masonry structures.
2. Design for Noise control & acoustic for an auditorium.
3. Computation of thermal load and associated design of building for thermal comforts and lighting.
4. Evaluation of a Building for Green Rating.

**COMPUTER BASED NUMERICAL TECHNIQUES (LAB.)**

**CE-13202**

**CREDIT: 02**

**0 0 3**

**List of Practical:**

- 1 Bisection Method
- 2 Iteration Method
- 3 Method of False Position
- 4 Newton-Raphson Method
- 5 Newton's forward difference Interpolation formula
- 6 Newton's backward difference Interpolation formula
- 7 Gauss's interpolation formula.
- 8 Lagrange's interpolation formula.
- 9 Numerical Integration using Simpson 1/3 Rule and Simpson 3/8 Rule and their applications.

**ENGINEERING GEOLOGY (LAB)**

**CE-13203**

**CREDIT: 2**

**0 0 3**

**Lab Practices:**

1. Identification of certain rock forming minerals
2. Identification of certain igneous, sedimentary and metamorphic rocks
3. Study of geological models
4. Study of geological maps
5. Study of thin sections

**References:**

1. *K V G K Gokhale: Principles of Engineering Geology, B.S. Publications.*
2. *Prabin Singh: Engg. and General Geology, Katson Publishing House.*
3. *D.S. Arora: Geology for Engineers, Mohindra Capital Publishers, Chandigarh.*
4. *P.K. Mukerjee: A text Book of Geology, Calcutta Word Publishers.*

## FLUID MECHANICS-I

AM-13101

CREDIT: 04

3 1 0

### UNIT 1. Introduction to Fluid Mechanics

02(L)

Fluid and continuum, Physical properties of fluids, Types of fluid flows, Rheology of fluids.

### UNIT 2. Fluid Statics and Kinematics

08(L)

Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Kinematics of Fluid flow: steadiness, uniformity, rotational and irrotational flows, streamline, streakline, pathline, continuity equation, stream function and velocity potential, circulation, applications of potential flow.

### UNIT 3. Dynamics of Fluid Flow and Dimensional Analysis

08(L)

Euler's Equation of motion along a streamline and its integration, Bernoulli's equation and its applications, momentum equation and its application to pipe bends.

Dimensional Analysis, Buckingham's Pi theorem, important dimensionless numbers and their physical significance, geometric, kinematic and dynamic similarity, model studies, Hydraulic similitude.

### UNIT 4. Laminar and Turbulent Flows

10(L)

Equation of motion for laminar flow through pipes, Stokes law, transition from laminar to turbulent flow, types of turbulent flow, isotropic and homogenous turbulence, scale and intensity of turbulence, eddy viscosity, Prandtl's mixing length theory, velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer (rigid theory), three reservoir problems and pipe network..

### UNIT 5. Hydrodynamic Boundary Layer

08(L)

Introduction with a historical background, boundary layer, displacement and momentum thickness, boundary layer over a flat plate, Prandtl boundary layer equation, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control, drag and lift, drag on a sphere, a 2D cylinder and an aerofoil, Magnus effect.

### UNIT 6. Measurement Techniques

04(L)

Flow measurement by Pitot tube, orifice, Venturi, nozzle, and bend meter, rotameter, notches and weirs, hot-wire anemometer, LDV and PIV, Turbine flowmeter, Vortex shedding flowmeter, magnetic flowmeter, Doppler Ultrasonic flowmeter, Coriolis flowmeter etc.

### References:

1. Fox, R.W., McDonald, A.T., *Introduction to Fluid Mechanics*, 7<sup>th</sup> edition, Wiley India.
2. Ojha, C.S.P., Berndtsson, R., Chandramouli, P.N., *Fluid Mechanics and Machinery*, Oxford University Press, New Delhi.
3. Majumdar, B., *Fluid Mechanics with Laboratory Manual*, PHI Learning, New Delhi.
4. Som, S.K. and Biswas G, *Introduction of Fluid Mechanics & Fluid Machines*, TMH, New Delhi.
5. Mohanty, A.K., *Fluid Mechanics*, PHI Learning, New Delhi.
6. Shames, I.H., *Mechanics of Fluids*, McGraw Hill, International Students Edition.
7. Agarwal, S.K., *Fluid Mechanics and Machinery*, TMH, New Delhi.
8. Rathakrishnan E., *Instrumentation, Measurements and Experiments in Fluids*, CRC Press, New York.
9. Garde, R.J., *Fluid Mechanics through Problems*, New Age International Pvt. Ltd, New Delhi.

## STRENGTH OF MATERIALS

**AM-13104**

**CREDIT: 04**

**3 1 0**

### **UNIT 1. Analysis of Stress and Strain**

**10(L)**

Uniaxial stress and strain: Stress, Strain, Hooke's Law, Stress-strain curves, Elastic Constants, Strain Energy, Statically Indeterminate problems, Thermal Effects, Impact Loading.

Biaxial stress and strain: Stress at a Point, Variation of Stress, Stress Transformation, Analysis of Strain, Strain-displacement relations, Strain transformation, Strain Measurements, Constitutive equations, Principal stresses and strain.

### **UNIT 2. Bending and Shear Stresses**

**06(L)**

Introduction, Pure Bending, Normal stresses in beams, Combined Bending and Axial Stress, Composite Beams, Shear Stress, Shear Centre, Strain energy in bending.

### **UNIT 3. Torsion**

**06(L)**

Introduction, Torsion of Circular Shaft, Power Transmitted by a Shaft, Compound Shaft, Tapered Shaft, Strain Energy in Torsion, Combined Bending and Twisting, Torsion of Thin Walled Tubes, Open and Closed Coiled Springs.

### **UNIT 4. Thin and Thick Cylinders & Spheres**

**06(L)**

Introduction, Thin Walled Shells, Thick Shells, Compound Cylindrical Shell.

### **UNIT 5. Deflections of Beams**

**05(L)**

Introduction, Equation of Elastic Curve, Methods for Determining Deflections - Double Integration, Macaulay's Method, Moment-Area Method, Conjugate-beam method, Castigliano's Theorem.

### **UNIT 6. Columns and Theories of Failure**

**07(L)**

Introduction, Euler's Theory for Long Columns, Rankine-Gordon Formula, Empirical Formulae, Eccentrically Loaded Columns.

### **References:**

1. *Elements of Strength of Materials*, S.P. Timoshenko and D.H. Young, East-West Press Pvt. Ltd. Publications.
2. *Mechanics of Materials*, Pytel and Kiusalaas, Cengage Learning Publications.
3. *Mechanics of Materials*, Gere and Timosheinko, CBS Publications.
4. *Mechanics of Materials*, E. P. Popov, Prentics Hall Publications.
5. *Strength of Materials*, G. H. Ryder, Macmillan India Limited.
6. *Strngth of Materials- Pytel and Singer*, Harpercollins College division publications.
7. *Strength of Materials*, Crandal, Dahal and Lardener, Tata Mcgraw Hill Publications.
8. *Mechanics of Materials- Riley, Struges and Morris*, John Wiley & Sons.

### FLUID MECHANICS-I (LAB.)

AM-13201

CREDIT: 02

0 0 3

**List of Experiments:**

1. To verify the momentum equation using the experimental set-up on diffusion of submerged air jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter, venturimeter, and bend meter and study the variation of the coefficient of discharge with the Reynolds number.
4. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
5. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
6. To study the variation of friction factor ' $f$ ' for turbulent flow in commercial pipes.
7. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

**References:**

1. Singh, S. *Experiments in Fluid Mechanics*, PHI Learning, New Delhi.
2. Prakash, M.N.S., *Experiments in Hydraulics and Hydraulic Machines: Theory and Procedures*, PHI Learning, New Delhi.

### STRENGTH OF MATERIALS (LAB.)

AM-13204

CREDIT: 02

0 0 3

**List of Experiments:**

1. Tension Test
2. Compression Test
3. Torsion Test
4. Beam Bending
5. Impact Tests
6. Closed and Open coiled springs
7. Shear Test
8. Buckling of Struts
9. Hardness Test (Brinell and Rockwell)
10. Tensometer (Tension Test)



## B. TECH. -IV SEMESTER

### BUILDING MATERIALS AND CONCRETE TECHNOLOGY

CE-14101

CREDIT: 3

3 0 0

#### Unit 1: Cement Concrete and Mortars

Composition, Physical & chemical properties of Cement. Hydration of cement, Testing of Cements as per BIS Specifications. Types of cements, Admixtures, Physical and mechanical properties of aggregates. Single & Multi- blend Concrete. Water for concrete making and curing. (8L)

#### Unit 2: Fresh Concrete & Hardened Concrete

Workability and its measurements, Segregation, Bleeding and Laitance in concrete, Strength of concrete, micro structure of hardened concrete, Factors affecting strength of concrete, Testing of Concrete, Ready Mix concrete, Compaction & curing of concrete, Principles of Concrete Mix Design. (8L)

#### Unit 3: Durability of Concrete

Mechanism of deterioration of concrete. Different modes of transport mechanism in concrete mass. Corrosion of reinforcement in concrete, causes and mitigation. High Performance concrete. (5L)

#### Unit 4: Special Concretes & Material Evaluation

Light weight concrete, High density concrete, Polymer concrete, No Fines concrete, Self compacted and Roller compacted and pumpable concrete, FRC, Sulphur Impregnated concrete. Material Testing & Instrumentation: NDT & Conventional Testing of concrete & concrete Structures. (5L)

#### Unit 5: Sustainability of Concrete Structures

Fundamentals, Carbon Economics, Life Cycle Costing and Energy considerations. (5L)

#### Unit 6: Metals & Non-Metals

Ferrous metals, Mechanical & physical properties of ferrous metals, Aluminium and Copper. (5L)

#### References:

1. S.K.Duggal: *Building Materials*, New Age International Publishers, New Delhi
2. "Civil Engineering Materials "Technical Teachers" Training Institute Chandigarh, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Rai Mohan and Jai Singh M.P. "Advances in Building Materials and Construction-CBRI Roorkee.
4. Mehta, P.K. & Monterio P.J. " Concrete Microstructure , Properties and Materials", TMH New Delhi
5. Spence RJS and Cook DJ- 'Building Materials in Developing Countries' John Wiley and Sons.
6. Neville A.M., *Properties of Concrete*, Pitman Publishing Company.
7. Shetty M.S. "Concrete Technology, Theory and Practices." S. Chand & Company Ltd., New Delhi.
8. Gambhir M.L. "Concrete Technology" - Tata McGraw Hill Publishing Company Ltd., New Delhi.

## SURVEYING

CE-14102

CREDIT: 4

3 1 0

### Unit- I : Introduction

(6 L)

Importance of surveying to engineers, plane and geodetic surveying, principles of surveying, classification of Surveys, Working principle, temporary adjustments and parts of prismatic compass, Dumpy & Tilting levels, EDM, Vernier Theodolite and Total Station

### Unit- II : Measurement of Distance, Direction & Angle, Traversing

(7L)

Distance measurement by EDM, Chainage & offsets, Tape corrections, Designation of Bearings & inter-conversion, local attraction, magnetic declination, Measurement of horizontal angles: repetition method & reiteration method, Traversing by compass and theodolite, computations of traverse coordinates, Traverse Adjustment

### Unit- III : Levelling, Contouring and Tacheometry

(7 L)

Direct levelling- basic terms and definitions, principle & type of direct levelling, reduction of field notes, level tube, curvature and refraction correction, balancing of sights, reciprocal levelling, Contours- Characteristics, methods and uses, Tacheometry: Basic terms & principles, Distance elevation formula for line of sight horizontal

### Unit- IV : Triangulation and Plane Table Surveying

(5 L)

Triangulation: Principle and classification, intervisibility of stations, Triangulation field work, Plane Table Survey: Principles, plane table equipments, methods- radiation, intersection & traversing, Resection by three point problem, Lehmann's rules

### Unit- V : Curve Surveying

(8 L)

Curve Surveying: Elements of simple circular curves, setting out simple circular curves by instrumental methods, introduction to compound curves and reverse curves, Transition curves and their characteristics, ideal transition curve, equations of various transition curves, Shift of transition curve, vertical curves & Setting out

### Unit- VI : Theory of Errors & Adjustment Computations

(5 L)

Errors, accuracy and precision, Characteristics of random errors, weighting of observations, propagation of errors, Principle of least squares, most probable values & their determination, Observation equations accompanied by condition equation, method of differences

### References:

1. *Surveying (Vol- I & II): S.K. Duggal, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.*
2. *Surveying (Vol- I & II): B.C. Punmia & A.K. Jain, Laxmi Publications, New Delhi.*
3. *Surveying (Vol- I & II): K.R. Arora, Standard Book House, New Delhi.*
4. *Plane Surveying & Higher Surveying: A.M. Chandra, New Age Int. (P) Ltd. Publisher, New Delhi.*
5. *Surveying: Bannister, A., Raymond S., Baker, R., Pearson Education, New Delhi.*

## ESTIMATION COSTING & VALUATION

**CE-14103**

**CREDIT: 4**

**3 1 0**

### **UNIT 1. Estimation Fundamentals**

**07(L)**

Importance of estimation, different types of estimates, general and detailed specifications. Methods of Estimation: Items of work for estimates, units and measurement of items.

### **UNIT 2. Detailed Estimation of Buildings and Analysis of Rates**

**07(L)**

Detailed estimates of a single roomed and a two roomed single storey residential building. Estimates of Steel Framed Industrial Building; Analysis of rates, material and other cost considerations. Resource planning through analysis of rates, market rates, PW.D. Schedule rates, non scheduled items and cost indices for building material and labour.

### **UNIT 3. Establishments, Organization Structures and Standard Work Procedures**

**07(L)**

Organization set up for various works departments. Duties and responsibilities of officers. Administrative, Technical and Financial approvals, System of P.W. accounts, Cash and cash book, Temporary advance, Stores, Issue of stores, Material at site account, Measurement and standard measurement book. Release of payments. Defect Liability considerations.

### **UNIT 4. Valuation of Assets**

**07(L)**

Standard Terminology, Factors affecting the values of property. Methods of valuation, years purchase, capitalized value and depreciation. Standard rent, free hold and lease hold propriety, Mortgage and easement.

### **UNIT 5. Estimation for Mechanized Construction and Infrastructure Projects**

**07(L)**

Estimation for mechanized construction including slip forming pumped concreting. Equipment costs and productivity analysis. Estimation of highways /irrigation/ airways projects including cross drainage structures.

### **UNIT 6. Computer Aided Estimation and Costing**

**05(L)**

Application of computer software for estimation and costing.

### **References:**

1. Chakraborty M., "Estimating costing and valuation in Civil Engg., Principle and applications (Authors Publication, Kolkata )
2. Frederick E. Gould. "Managing the Construction Process Estimating, Scheduling and Project Control", Pearson Education
3. B.N. Dutta "Estimating & Costing in Civil Engineering," UBS Publishers & Distributors Pvt. Ltd. New Delhi.
4. CPWD Works Manual 2012.

## **BUILDING MATERIALS AND CONCRETE TECHNOLOGY (LAB.)**

**CE-14201**

**CREDIT : 2**

**0 0 3**

### **List of Practicals :**

1. (i) To determine the specific gravity of cement using lechatelier flask and the fineness by sieve analysis.  
(ii) To determine the normal consistency and setting times.
2. (i) To assess the soundness of OPC using lechatelier apparatus.  
(ii) To determine the compressive strength of ordinary portland cement.
3. To determine the specific gravity, bulk density and water absorption of aggregates.
4. To study the phenomenon of bulking of sand.
5. To draw the grading curves for fine and coarse aggregates and hence to determine their fineness moduli.
6. To determine the crushing value, impact value and ten percent fine value for coarse aggregates.
7. To measure the workability of concrete using slump cone, compaction factor Apparatus and Vee Bee Consistometer.
8. (i) To determine compressive strength and water absorption of burnt clay bricks.  
(ii) To assess the degree of efflorescence, dimensional tolerance and warpage in burnt clay bricks.
9. To determine the physical and mechanical properties of reinforcing steel.
10. To design a concrete mix of given specifications and to evaluate associated trial mixes.

## **SURVEYING (LAB.)**

**CE-14202**

**CREDIT: 2**

**0 0 3**

### **List of Practicals:**

1. To study topographical maps and prepare conventional symbols chart along with map numbering system (I & AC map series).
2. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
3. To find out reduced levels of given points using dumpy level.
4. To perform fly levelling with a tilting level.
5. To find out reduced levels with an Automatic Level.
6. To measure vertical angle of given points by Vernier theodolite.
7. To measure horizontal angle between two objects by repetition method with three repetitions.
8. To measure horizontal angle between four objects by method of reiteration.
9. To determine tacheometric constants of a Vernier Theodolite.
10. To set out a simple circular curve by Rankine's method of tangential angles.
11. To plot details using Total Station (2 turns).

## STRUCTURAL ANALYSIS- I

**AM-14104**

**CREDIT: 04**

**3 1 0**

### **UNIT 1. Introduction & Analysis of Plane Structures**

**09(L)**

Introduction and Classification of Structures, Review of AFD, SFD and BMD for Beams, Degrees of Freedoms, Static and Kinematic Indeterminacy of Structures, Analysis of Compound and Complex Trusses, Analysis of Plane Frames.

### **UNIT 2. Displacements of Plane Structures**

**07(L)**

Introduction, Energy methods, Maxwell's Reciprocal & Betti's Theorem, Unit Load method, Deflection of trusses and plane frames.

### **UNIT 3. Rolling Loads and Influence Line Diagrams**

**07(L)**

Introduction, Influence Line Diagrams for Beams & Trusses, Absolute Maximum Bending Moments, Muller- Breslau principle and its applications.

### **UNIT 4. Arches, Cables and Suspension Bridges**

**07(L)**

Introduction, Linear Arch, Eddy's Theorem, Three-Hinged & Two-Hinged Arches, Spandrel Braced Arch, Influence Lines for Arches, Analysis of Cables, Suspension bridges with three and two hinged stiffening girders.

### **UNIT 5. Unsymmetrical Bending**

**04(L)**

Introduction, Location of Neutral axis, Computation of Stresses and deflections.

### **UNIT 6. Curved Beams**

**06(L)**

Bending of curved beams in plane of bending, stresses in bars with small and large initial curvatures, Beams Curved in plan.

### **References:**

1. *Structural Analysis, Hibbeler, Pearson Publications.*
2. *Structural Analysis, Aslam Kassimali, Cengage Learning Publications.*
3. *Structural Analysis in Theory and Practice, Alan Williams, Elsevier Publications.*
4. *Elementary Structural Analysis, C. H. Norris, J. B. Wilbur and S. Utku, Tata Mcgraw Hill Publications.*
5. *Structural Analysis, L.S. Negi and R. S. Jangid, Tata Mcgraw Hill Publications.*

## FLUID MECHANICS-II

AM- 14105

CREDIT: 04

3 1 0

### UNIT 1. Introduction to Open Channel Hydraulics

04(L)

Introduction, difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation.

### UNIT 2. Uniform Flow in Open Channel

08(L)

Introduction, Chezy's and Manning's equations for uniform flow in open channel, velocity distribution, most efficient channel section. Energy and momentum principles, Critical depth, concepts of specific energy and specific force, application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. IV Non-Uniform Flow in Open Channel, Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods, flow in channels of non-linear alignment.

### UNIT 3. Hydraulic Jumps, Surges, and Water waves

08(L)

Classical hydraulic jump, evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, open channel surge, celerity of the gravity wave, deep and shallow water waves.

### UNIT 4. Hydraulic Pumps

08(L)

Rotodynamic pumps, classification on different basis, basic equations, velocity triangles, manometric head, efficiencies, pumps in series and parallel, multi-stage pumps, cavitation in pumps.

### UNIT 5. Hydraulic Turbines

10(L)

Introduction to Hydroelectric power station, penstock and surge tank, water hammer (elastic theory), Rotodynamic machines, Pelton turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation.

### UNIT 6. Performance Evaluation of Hydraulic Machines

04(L)

Evaluation of performance of turbines and pumps, Main characteristics and operating characteristics, Muschel curves, Design point and operating point.

### References:

1. Ranga Raju, K.G., *Flow through open channels*, T.M.H. 2nd edition.
2. Lal, J., *Hydraulic Machines*, Metropolitan Book Co. Pvt. Ltd., Delhi.
3. Ojha, C.S.P., *Fluid Machinery and Applied Hydraulics*, Oxford University Press, New Delhi.
4. Vasandani, V.P., *Theory of Hydraulic Machines*, Khanna Publishers, New Delhi.
5. Sawhney, G.S., *Thermal and Hydraulics Machines*, PHI Learning, New Delhi.
6. Majumdar, B., *Fluid Mechanics with Laboratory Manual*, PHI Learning, New Delhi.
7. Karassic, I.J., *Pump Handbook*, Tata McGraw Hill Ltd. New Delhi.
8. Som, S.K. and Biswas G, *Introduction of Fluid Mechanics & Fluid Machines*, TMH, New Delhi.

## PRINCIPLES OF MANAGEMENT

**HS- 14101**

**CREDIT: 03**

**3 0 0**

### **UNIT 1: Concept of business environment**

Significance and nature, the interaction matrix of different environment factors, environmental scanning, basic philosophies of capitalism and socialism with their variants. 5(L)

### **UNIT 2: Politico-legal environment**

Relationship between business and Government of India, introduction to some important business laws: competition act, FEMA, SEBI, RBI, consumer protection act, changing dimensions of these laws and their impact on business, Economic environment: philosophy and strategy of planning in India, concept of mixed economy, their changing role, policy with regard to small scale industries. 5(L)

### **UNIT 3: Technological and socio-cultural environment**

Policy for research and development in India, multinationals as source of technology; foreign collaborations and joint ventures, liberalization in India: the new economic Policy; globalisation; FDI policy, reforms in financial Sector. 7(L)

### **UNIT 4: General Management**

Management concepts, theories and practices, functions of management – Planning, Organizing, directing-leadership, motivation, communication and controlling, decision making. 10(L)

### **UNIT 5: Organizational Behaviour**

Organizational change, conflict management and stress management 5(L)

### **UNIT 6: Functional management**

Human resource management, financial management, marketing management 5(L)

### **References:**

1. Principles & Practices of Management by L.M. Prasad., Sultan Chand and Sons
2. Management by Harold, Koontz and Cyrilo Donell., Mc.Graw Hill.
3. Business and society by Khan Farocq., S Chand, Delhi .
4. Indian Economy Dutt R and Sundharam K.P.M., S .Chand ,Delhi .
5. Business Environment by Francis Cherunilam, Himalaya Publishing House, Bombay.

**FLUID MECHANICS-II (LAB.)**

**AM- 14205**

**CREDIT: 02**

**0 0 3**

**List of Practical:**

1. To study the characteristics of hydraulic jump in an open channel.
2. To study the velocity distribution on an open channel and to determine the energy and momentum correction factors.
3. To study performance of two Centrifugal pumps connected in series and parallel.
4. To study performance of a Reciprocating pump.
5. To study the impact of jets on a flat plate.
6. To study performance of a Pelton wheel.
7. To study performance of a Francis turbine.
8. To study performance of a Kaplan Turbine.

**References:**

1. Singh, S. *Experiments in Fluid Mechanics*, PHI Learning, New Delhi.
2. Prakash, M.N.S., *Experiments in Hydraulics and Hydraulic Machines: Theory and Procedures*, PHI Learning, New Delhi.



## B. TECH. -V SEMESTER

### GEOTECHNICAL ENGINEERING – I

CE- 15101

CREDIT: 4

3 1 0

**UNIT 1. Soil formation, Properties and Classification of soils** **10(L)**

Soil mechanics and its importance, Particle size analysis, Phase relationship, Index properties, Soil structure and Clay mineralogy, Identification and Classification of soils, Soil Classification systems.

**UNIT 2. Permeability and Capillarity** **08(L)**

Types of soil water, effective stress principle, Permeability and seepage of soils, Coefficient of permeability and its determination in laboratory and field, Quick sand and Liquefaction phenomenon, Seepage analysis, Flow nets and its construction, Seepage through earthen embankments.

**UNIT 3. Soil Compaction** **05(L)**

Theory of compaction, Standard and Modified Proctor test, Effect of compaction on properties of soils, Field compaction of soils, Compaction control in fields.

**UNIT 4. Consolidation of Soils** **07(L)**

Compressibility of soils, Types of consolidation, Terzaghi's theory of consolidation, Consolidation test, Determination of coefficient of consolidation, Pre-consolidation pressure and its determination, Time rate of consolidation, Computation of settlement, Sand drains.

**UNIT 5. Shear Strength of Soils** **06(L)**

Mechanism of shear resistance, Mohr-Coulomb theory, Shear strength and effective stress principle, Shear tests under different drainage conditions, Pore pressure parameters, Shear characteristics of cohesionless and cohesive soils, Modified failure envelop, Stress path.

**UNIT 6. Stability of Slopes** **04(L)**

Types of slope failure, Stability of infinite and finite slopes, Taylor's stability number, Stability analysis – Culmann's method, Swedish Circle method, Friction circle method, Bishop's method, Stability charts.

**References:**

1. *Lambe & Whitman: Soil Mechanics, Wiley-India.*
2. *Gopal Ranjan and A.S.R. Rao: Basic and Applied Soil Mechanics, New Age International*
3. *B. M. Das: Principles of Geotechnical Engineering, CL-Engineering.*
4. *D.F. Mc Garthy: Essentials of soil mechanics and foundation. New Age International*
5. *Alam Singh: Modern Geotechnical Engineering., CBS publisher*
6. *K.R. Arora: Soil Mechanics and Foundation Engineering, Standard Publishers Distributors*
7. *Purushotama Raj: Geotechnical Engineering, New Age International Limited*

## TRANSPORTATION ENGINEERING –I

**CE- 15102**

**CREDIT: 4**

**3 1 0**

### **UNIT 1. Highway Planning and Alignment**

**06(L)**

Introduction to transport systems; various modes of transportation. Highway Development in India; Institutions for Highway Development at National level; Methods of Highway Planning. Requirements of Ideal Alignment, Factors controlling highway alignment; engineering surveys for highway planning.

### **UNIT 2. Geometric Design of Highways**

**10(L)**

Classification and cross section of urban and rural roads (IRC), Highway cross sectional elements. Sight distances - Cross sectional elements, camber, shoulder Factors affecting Sight Distances, PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections and Intermediate Sight. Design of Horizontal and Vertical Alignments.

### **UNIT 3. Traffic Engineering**

**08(L)**

Traffic characteristics Volume studies; Speed study; Traffic flow characteristics; capacity, density; Traffic control devices: Signs, signals, island; intersections: at grade and grade separated intersections, rotary intersection, and design of signals at intersections.

### **UNIT 4. Pavement Analysis and Design**

**07(L)**

Rigid and Flexible Pavements: Components and their functions, Design principles of Flexible and Rigid Pavements, Factors affecting the Design of Pavements: ESWL, Climate, Sub-grade Soil and Traffic, Design Practice for Flexible Pavements [CBR method, IRC Method and Recommendations- Problems], Design Practice for Rigid Pavements – [IRC Recommendations-Problems], Joints.

### **UNIT 5. Highway Construction**

**06(L)**

Material Specification and Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications], Highway Drainage [IRC Recommendations]

### **UNIT 6. Highway Failures and Maintenance**

**05(L)**

Types of defects in Flexible and Rigid pavements, their Symptoms, Causes and Treatments, Special Repairs. Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening -Overlay design by Benkelman Beam Method.

### **References:**

1. *Highway Engineering* by S.K. Khanna and C.E.J. Justo, Nem Chand Publication.
2. *Transportation Engineering* by Animesh Das and P. Chakravorhy, Tata McGraw Hill.
3. *Principle and Practices of Highway Engineering* by L.R. Kadiyali and N.B. Lal, Khanna Publishers.

## CONCRETE STRUCTURES-I

**CE- 15103**

**CREDIT: 4**

**3 1 0**

### **UNIT 1. Working Stress Design**

**06(L)**

Introduction to Reinforced Cement Concrete, Working Stress Design Method, Assumption, Distribution of Stresses on the cross section in bending, transformed area, Analysis and Design of a rectangular singly and doubly reinforced section, T and L sections for flexure , shear and bond.

### **UNIT 2. Limit State Design**

**08(L)**

Limit State Design Method, Assumptions, Distribution of stresses on the cross section in bending, Analysis and Design of a rectangular singly and doubly reinforced section, T and L sections.

### **UNIT 3. Behaviour of Section in Shear & bond**

**06(L)**

Behaviour of RC beam in shear, shear strength of beam with and without shear reinforcement, Minimum and Maximum shear reinforcement, Design of beam in shear using Limit state methods.

Nature of bond between steel and concrete. Development of bond stress in reinforcement, Concept of development length and anchorage, Design of RC section in bond and calculation of development length using Limit state methods.

### **UNIT 4. Design of Slab & Staircase**

**06(L)**

Design of one-way and two-way solid slabs, and design of staircase.

### **UNIT 5. Design of Compression Members**

**08(L)**

Classification of Compression members, Effective length, Slenderness ratio and slenderness limit, Axially loaded short column's design Limit State methods, Increase in permissible load in helically reinforced columns.

Eccentrically loaded columns, Minimum eccentricity,  $P_u$  &  $M_u$  interaction diagrams Design of Columns using IS-456 Design Aids with Uniaxial and biaxial bending.

### **UNIT 6. Design of Footings**

**08(L)**

Structural behaviour of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings, Design of strap footing.

### **References:**

1. *Fundamentals of Reinforced Concrete Structures* , M L Gambhir , PHI
2. *Reinforced Concrete Design* , A K Jain , Nem Chand
3. *Reinforced Concrete Design* , P Dayratnam , Oxford IBH
4. *Reinforced Concrete* , Pillai & Menon , TMH

## ENVIRONMENTAL ENGINEERING – I

**CE- 15104**

**CREDIT: 4**

**3 1 0**

### **UNIT 1. Water Demand and Sources**

**07(L)**

Introduction, population forecasting, variations in water demand, estimation of quantity of water. Sources of Water: determination of capacity of impounding reservoirs: Suitability of surface and subsurface sources; Rain water harvesting intake structures.

### **UNIT 2. Water Quality and Conveyance**

**07(L)**

Water Quality Parameters and standards, Conveyance of Water, Appurtenances and valves; types of pumps with fittings.

### **UNIT 3. Distribution Networks**

**06(L)**

Storage and Distribution of water: Analysis of distribution network, Plumbing system- Layout, plumbing equipments and operation, installation and maintenance

### **UNIT 4. Sewage System & Wastewater flows**

**07(L)**

Wastewater Collection Systems, quality examination of wastewater, effluent discharge standards .Estimation of wastewater flows and storm run off to Indian catchments

### **UNIT 5. Flow in Sewers**

**06(L)**

Flow in Full and partially full sewers, Design of sewers and storm water drains, laying of sewers, testing and ventilation of sewers.

### **UNIT 6. Sewer Appurtenances**

**07(L)**

Sewer appurtenances: Manholes, catch pits, storm relief works etc., House drainage and Sanitary fixtures and fittings.

### **References:**

1. *McGhee: Water supply and sewerage*, Tata McgrawHill, publication.
2. *Peavy, Rowe and Techbanoglous: Environmental Engineering*, Tata McgrawHill, publication.
3. *MetCalf & Eddy: Wastewater Engineering: Treatment and Reuse*, Tata McgrawHill, publication.
4. *Sawyer and McCarty: Chemistry for Environmental Engineering*, Tata McgrawHill, publication.
5. *Garg S. K.: Environmental Enggineering (I&II)*, Khanna publication, New Delhi.
6. *B.C. Punamia & Jain A.: Environmental Enggineering (I&II)*, Laxmi publication, New Delhi.

## GEOINFORMATICS

CE- 15105

CREDIT: 4

3 1 0

### Unit- I : Photogrammetry

(6 L)

Aerial Photographs- Basic terms & Definitions, Photo scale, relief displacements, Tilted Photograph, Flight Planning, Stereoscopy, Characteristics of photographic images, Fundamentals of aerial photo-interpretation

### Unit- II : Remote Sensing

(7 L)

Physics of remote sensing, remote sensing system, Spectral reflectance curves, resolution and multi-concept, Sensors and orbital characteristics, Visual interpretation: FCC, Indian Remote Sensing satellites & data products

### Unit- III : Satellite Image Processing

(6 L)

Satellite Image- Characteristics and formats, Image histogram, Land use and land cover classification system, Image rectification, Image Classification: Unsupervised & Supervised, Applications of remote sensing

### Unit- IV : Geographic Information System (GIS)

(8 L)

Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector data structures, topology, creation of integrated geographic database, Query formation, Buffering, Spatial Overlay, Data output, GIS Applications

### Unit- V : Global Positioning System (GPS)

(6 L)

Introduction, Satellite navigation System, GPS- Space segment, Control segment, User segment, GPS satellite signals, Receivers, Static, Kinematic and Differential GPS

### Unit- VI : Applications of Geoinformatics

(5 L)

Concepts of Open Source Software, Open source software in the field of GIS and Satellite image processing, Application of remote sensing, image processing, GIS and GPS in Civil Engineering and related fields

### References:

1. *Remote Sensing & Image Interpretation: Lillesand, T.M. & Kiefer, R.W, Wiley Students Edition, India.*
2. *GIS & Remote Sensing: Chandra, A.M. & Ghosh, S.K., Narosa Publications, India.*
3. *Computer Processing of Remotely Sensed Images: Mather, P.M., John Wiley & Sons.*
4. *Essentials of GPS by N.K. Agarwal, Spatial Networks Publishers, Hyderabad.*
5. *Remote Sensing & GIS: M. Anji Reddy, BS Publications, Hyderabad.*

**GEOTECHNICAL ENGINEERING-I (LAB.)**

**CE- 15201**

**CREDIT: 2**

**0 0 3**

**List of Experiments:**

1. Visual identification and specific gravity
2. Sieve Analysis
3. Hydrometer Analysis
4. Atterberg's Limits
5. Relative Density Test
6. Proctor Compaction Test
7. In site Density-Core Cutter & Sand Replacement Method.
8. Permeability Test: Constant Head
9. Permeability Test: Variable Head
10. CBR Test
11. Consolidation test
12. Direct Shear Test
13. Unconfined Compression Test
14. Triaxial test

**TRANSPORTATION ENGINEERING – I (LAB.)**

**CE- 15202**

**CREDIT: 2**

**0 0 3**

**List of Experiments:**

1. Tests on Aggregate:
  - (a) Impact Test.
  - (b) Abrasion Test.
  - (c) Shape Test.
2. Tests on Bituminous materials:
  - (a) Penetration Test.
  - (b) Viscosity Test.
  - (c) Ductility Test.
  - (d) Stripping Value Test.
  - (e) Softening point Test.
  - (f) Flash and Fire point Test.
3. Marshal Stability Test.
4. Traffic studies:
  - (a) Traffic Volume study.
  - (b) Traffic speed studies.

## STRUCTURAL ANALYSIS- II

**AM- 15101**

**CREDIT: 04**

**3 1 0**

**UNIT 1. Introduction**

**05(L)**

Introduction, Force and Displacement Methods of Analysis of Indeterminate Structures, Method of Consistent Deformation for beams and plane frames.

**UNIT 2. Strain Energy Methods**

**04(L)**

Introduction, Method of Minimum Strain Energy for indeterminate beams, Trusses and plane frames.

**UNIT 3. Moment Distribution and Slope Deflection Methods**

**07(L)**

Introduction, Moment distribution and Slope Deflection methods for continuous beams and plane frames.

**UNIT 4. Matrix Method of Analysis**

**12(L)**

Introduction, Flexibility Method- Application to Beams, Trusses, Frames and Grid Structures; Stiffness Method- Application to Beams, Trusses, Frames and Grid Structures (including plane and space structures.

**UNIT 5. Computer Oriented Direct Stiffness Method**

**08(L)**

Introduction, Application to Beams, Frames and Trusses.

**UNIT 6. Plastic Analysis of Structures**

**04(L)**

Introduction, Analysis of Plastic Structures.

**References:**

1. *Structural Analysis, Hibbeler, Pearson Publications.*
2. *Structural Analysis, Aslam Kassimali, Cengage Learning Publications.*
3. *Structural Analysis in Theory and Practice, Alan Williams, Elsevier Publications.*
4. *Elementary Structural Analysis, C. H. Norris, J. B. Wilbur and S. Utku., Tata Mcgraw Hill Publications.*
5. *Structural Analysis, L.S. Negi and R. S. Jangid, Tata Mcgraw Hill Publications.*
6. *Intermediate Structural Analysis, C. K. Wang, Tata Mcgraw Hill Publications.*
7. *Matrix Analysis of Framed Structures, W. Weaver (Jr.) and J. M. Gere, CBS Publications.*

## STRUCTURAL ANALYSIS- II (LAB.)

**AM- 15201**

**CREDIT: 02**

**0 0 3**

**List of Experiments:**

1. Analysis of Redundant Joint
2. Flexural Stiffness of Beam
3. Verification of Maxwell's Reciprocal Theorem
4. Analysis of Curved Members
5. Verification of Carry Over Factor
6. Three Hinged Arch
7. Two Hinged Arch
8. Elastically Coupled Beam
9. Unsymmetrical Bending

## B. TECH. -VI SEMESTER

### CONCRETE STRUCTURES-II

CE- 16101

CREDIT: 4

3 1 0

**UNIT 1. Design of Flat & Circular Slabs**

**06(L)**

Design of flat slabs with and without drops. Circular slabs with various edge and loading conditions, and their usages. Design of Coffer slab.

**UNIT 2. Design of Circular Water Tanks**

**06(L)**

Water tanks: Design criteria, material specifications and Permissible stresses for water retaining structures, Design of circular water tanks with fixed & flexible base situated on the ground/underground.

**UNIT 3. Design of Rectangular Water Tanks**

**06(L)**

Design of square /rectangular tanks situated on the ground/underground using approximate method and IS- code method.

**UNIT 4. Design of Beams for Flexure, Shear & Bond**

**04(L)**

Failure of beam under torsion, interaction between shear and torsion and between moment and torsion, Concept of equivalent shear and moments. Analysis and design of beam curved in plan.

**UNIT 5. Design of Retaining Walls**

**08(L)**

Structural behaviour of retaining wall, stability of retaining wall against over-turning sliding and pressure developed under the base, Design of T-shaped retaining wall, Concept of counterfort retaining wall.

**UNIT 6. Prestressed Concrete Design**

**12(L)**

Advantages of prestressing, methods of prestressing, Losses in prestress, analysis of simple prestressed rectangular and T-section. Introduction to design of element , load balancing concept , profile of cable.

**References:**

1. *Reinforced Concrete Design, Limit State Method* ,Jain A.K. , NemChand
2. *Reinforced Concrete Structures* , M L Gambhir , PHI
3. *Reinforced Concrete Design* , Pillai & Menon , TMH
4. *Design of Reinforced Concrete Structures* , Dayaratnam , P. , Oxford IBH
5. *Prestressed Concrete* , Krishna Raju , N , CBS
6. *IS 456-2000: Code of practice for plain & reinforced concrete.*
7. *SP-16: Design Aids of Reinforced Concrete to IS: 456-1978.*
8. *IS 3370-1968 & IS 3370-2009: Code of practice for water retaining structures.*



## ENVIRONMENTAL ENGINEERING – II

CE- 16102

CREDIT: 4

3 1 0

### UNIT 1. Introduction to Water Treatment

07(L)

Water Treatment units, processes, flow sheets. Sedimentation: - Theory and mechanisms, Removal efficiency of discrete and flocculent particles, Design of primary and secondary settling tank.

### UNIT 2. Coagulation and Flocculation

06(L)

Coagulation, Mechanisms of coagulation, optimum dose of coagulants, design of rapid mixer. Flocculation: Theory and mechanisms, design of hydraulic and mechanical flocculator.

### UNIT 3. Filtration, Disinfection and Softening

07(L)

Filtration: Theory and mechanisms, hydraulics of filtration and back-washing, Design of Slow sand filter, Rapid sand filter, dual and multi-media filters. Disinfection, methods of disinfection, Various forms of chlorine application and equipments, Water Softening: Methods of water softening, estimation of dose of chemicals.

### UNIT 4. Introduction to Wastewater Treatment

07(L)

Wastewater Treatment: Unit operations and unit processes, primary, secondary and tertiary treatments, BOD kinetics. microbial growth kinetics and various relationships, Design of Primary treatment units.

### UNIT 5. Secondary Treatments- Aerobic

07(L)

Secondary treatment: Biological treatment- its principle, Design of Activated sludge process- and modifications, trickling filter-theory and design, design of oxidation ponds and oxidation ditches and rotating biological contactor.

### UNIT 6. Anaerobic Treatment and Disposal of Effluent

06(L)

Principles of Anaerobic Treatment, Introduction to sludge treatment, anaerobic digestion of sludge, design of anaerobic digester and septic tank. Disposal of wastewater on land and in water bodies, stream sanitation.

### References:

1. *Masters: Introduction to Environmental Engineering and Science, Prentice Hall Publication.*
2. *McGhee: Water supply and sewerage, Tata McGrawHill, publication.*
3. *Peavy, Rowe and Techbanoglous: Environmental Engineering, Tata McGrawHill, publication.*
4. *Garg S. K.: Environmental Enggineering (I&II), Khanna publication, New Delhi.*
5. *MetCalf & Eddy: Wastewater Engineering: Treatmment and Reuse, Tata McGrawHill, publication.*
6. *Mannual on Water Supply and Treatment, CPHEEO, Govt. of India.*
7. *Mannual on Sewerage and Sewage Disposal, CPHEEO, Govt. of India.*

## GEOTECHNICAL ENGINEERING – II

**CE- 16103**

**CREDIT: 4**

**3 1 0**

### **UNIT 1. Stresses in Soils**

**06(L)**

Causes of stress in soil, Geostatic stress, Boussinesq's equation, Stress distribution diagrams, Vertical stress in soils under different types of loading, Newmark's influence chart, Westergard's equation.

### **UNIT 2. Earth Pressure and Retaining Walls**

**06(L)**

Types of lateral earth pressure, Rankine's and Coulomb's earth pressure theory, Graphical methods of determination of lateral earth pressures, Types of retaining walls, Design Principles, Stability conditions, Sheet pile walls.

### **UNIT 3. Bearing Capacity and Shallow Foundation**

**10(L)**

Methods of determining bearing capacity, Analytical methods of determining bearing capacity – Rankine's method, Terzaghi's theory, Meyerhof's method, Brinch-Hansen's method, Skempton's analysis, Vesic's analysis, IS code method, Settlement of foundation, Differential settlement, Settlement analysis, Bearing capacity based on tolerable settlement, Field tests, Types & design of shallow foundations.

### **UNIT 4. Pile Foundation**

**06(L)**

Type of pile foundation, Types, Pile driving, Pile capacity by static and dynamic analysis, Pile load tests, Negative skin friction, Group action of piles, Settlement of pile groups, Under reamed piles – analysis and design.

### **UNIT 5. Well Foundation**

**07(L)**

Types of wells, Component of wells, Depth and bearing capacity of well foundation, Forces acting on well foundation, Construction and sinking of well foundation, Measures to prevent and rectify tilts and shifts.

### **UNIT 6. Machine Foundation**

**05(L)**

Types, Design criteria, Equation of motion, Natural frequency, Design of Reciprocating, Impact and Rotary type of machine foundation as per codal provisions.

### **References:**

1. *J.E. Bowels: Foundation Analysis and Design, McGraw-Hill.*
2. *W. C. Teng : Foundation Design, Prentice-Hall.*
3. *B. M. Das: Principles of Foundation Engineering, PWS Publishing.*
4. *K.R. Arora : Soil Mechanics and Foundation Engineering, Standard Publishers Distributors.*
5. *P. C. Varghese: Foundation Engineering, PHI Learning Private Limited.*
6. *V. N. S. Murthy: Advance Foundation Engineering, CBS Publisher.*
7. *Nainan P. Kurian: Design of Foundation Systems, Narosa Publishing House.*

## TRANSPORTATION ENGINEERING –II

**CE- 16104**

**CREDIT: 4**

**3 1 0**

### **UNIT 1. Introduction**

**03(L)**

Introduction to Indian Railways, Modes of Transportation, Classification of Railway Lines in India, Undertakings under Ministry of Railways.

### **UNIT 2. Components of Track and Track Alignment**

**08(L)**

Permanent way, Rail gauges, Coning of wheels, Rails, Creep of rail, Rail Fastenings, Sleepers, sleeper density, Ballast, Traction and Tractive Resistances. Alignment of Railway Lines, Engineering Surveys, Plate laying methods.

### **UNIT 3. Geometric Design of Track**

**08(L)**

Gradients, Grade compensation on curves, Super elevation, Cant deficiency and Cant excess, Negative Super elevation. Curves, Extra clearance on curves, permissible speed on tracks, Widening of gauges on curves.

### **UNIT 4. Points and Crossings & Signalling**

**08(L)**

Switches, Components and types of crossing, Turnouts, Design of turnouts. Signalling: Classification, Signalling systems, systems for controlling train movements, Interlocking.

### **UNIT 5. Stations and Yards**

**03(L)**

Classification of railway stations and yards; platforms, sidings.

### **UNIT 6. Airport Engineering**

**12(L)**

Air Transport in India, Components of Air Transportation, Air craft characteristics affecting airport design, Airport Planning, Runway Design: runway orientation; basic runway length; corrections to runway length. Airport Configuration: Runway configurations and operations, Taxiway configurations, Runway pavement design, design of overlay, Airport Layout, Runway lighting and Marking.

### **References:**

1. *Railway Engineering by Satish Chandra and M. M. Agarwal, Oxford University Press.*
2. *A Text Book of Railway Engineering by S. C. Saxena and S. P. Arora, Dhanpat Rai Publications.*
3. *Airport Planning and Design by S. K Khanna, M.G. Arora and S.S Jain, Nem Chand & Bros. Roorkee.*

### CONCRETE STRUCTURES-II (LAB.)

**CE- 16201**

**CREDIT: 2**

**0 0 3**

**List of Practical in Structure Detailing Lab:**

1. Simple Beam/Lintel
2. T-Beam floor
3. Rectangular Slabs
4. Brick wall and Isolated footing
5. Combined Rectangular and Trapezoidal Footing
6. Water tank
7. T. shape Retaining wall
8. Details of Flat slab & Circular Slabs
9. Details of Stair Case

**Note** - Three hour practical is for drawing work (Manual & computer Aided).

### ENVIRONMENTAL ENGINEERING – II (LAB.)

**CE- 16202**

**CREDIT: 2**

**0 0 3**

**List of Experiments:**

1. Determination of pH, electrical conductivity & turbidity of the given water sample.
2. Determination of acidity & alkalinity of given sample.
3. Determination of solids (TS, TSS, TDS, VSS and Inorganic solids) in a given wastewater sample.
4. Determination of optimum coagulant dosage required for treating the given water sample.
5. Determination of chloride content & hardness in given water sample.
6. Determination of residual chlorine in the given water sample & the chlorine demand.
  
7. Determination of amount of iron present in the given sample.
8. Determination of amount of dissolved oxygen (DO) present in the sample.
9. Determination of amount of nitrate in the given water sample using PDA method.
10. Determination of amount of fluoride present in the given water sample.
11. Determination of chemical oxygen demand (COD) of given sample.
12. Determination of biochemical oxygen demand (BOD) of given sample.

**References:**

1. *Standard Methods for the Examination of Water & Wastewater*, APHA, AWWA, U.S.A.
2. *Sawyer and McCarty: Chemistry for Environmental Engineering*
3. *Kotaiah: Environmental Engineering Laboratory Manual*, Charotar Publishing House.

**GEOTECHNICAL ENGINEERING – II (LAB.)**

**CE- 16203**

**CREDIT: 2**

**0 0 3**

**List of Practical:**

1. Methods of Soil Exploration
2. Free swell Index & Differential free swell Index
3. Swelling pressure test
4. Static cone penetration test
5. Dynamic cone penetration test
6. Standard penetration test
7. Plate load test.
8. Laboratory vane shear test
9. Field vane shear test
10. Pile load test
11. Geophysical methods
12. Planning of site investigations for a real life problem.

### COMPUTER AIDED DESIGN (CIVIL) (LAB.)

**CE- 16205**

**CREDIT: 2**

**0 0 3**

#### List of Practical:

1. Introduction to MATLAB to solve the problems related to analysis of Civil Engineering structures.
2. Develop the algorithms and computer programmes to develop SFD and BMD of the following structures subjected to different kind of loading conditions:
  - (i) Cantilever Beam
  - (ii) Simply Supported Beam
  - (iii) Fixed Ended Beam
  - (iv) Propped Cantilever Beam
3. Write computer programmes to generate the element stiffness matrix and global stiffness matrix for the following structures:
  - (i) Continuous beam
  - (ii) Plane Truss
  - (iii) Plane Frame
4. Write computer programmes to generate the global load vectors for the above structures and determine the unknown joint displacements, unknown joint reactions and member end forces.
5. Write computer programmes to design the different elements of the building structure using Limit State Method.
6. Applications of software packages to solve the problems related to analysis and design of Civil Engineering structures.

#### References:

1. *Computer aided design: software and analytical tools* by C. S. Krishnamoorthy, S. Rajeev and Arunachalam Rajaraman, Narosa Publication, Second Edition, 2009.
2. *Computer aided design in reinforced concrete* by V. L. Shah, Structures Publishers, Third Edition, 1998.
3. *Artificial intelligence and expert systems for engineers* by C. S. Krishnamoorthy and S. Rajeev, CRC Press, First Edition, 1996.
4. *Developments in computer aided design and modelling for civil engineering* by B.H.V. Topping, Civil-Comp Press, First Edition, 1995.
5. *Developments in computer aided design and modelling for structural engineering* by B.H.V. Topping, Civil-Comp Press, First Edition, 1995.

### SURVEY CAMP

**CE- 16206**

**CREDIT: 4**

**2 Weeks**

Survey camp will contain 2 weeks Field Work and submission of associated maps/ reports.

## VII-Semester

### STEEL STRUCTURES

**CE-17101**

**CREDIT: 3**

**3-0-0**

**UNIT 1 : General Considerations**

(6 L)

General Considerations : Structural Steel, Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Introduction to Plastic Analysis and Design, Working stress and Limit State Method of Steel Design

**UNIT 2 : Connections**

(6 L)

Types of connections & joints, Bolted and Welded Connections, Load Transfer Mechanism, Failure Modes, Prying Action, Slip-Critical Connections, Moment Resistant Connections, Eccentric Connections, Beams-Column Connections, Bracket Connections, Framed Connections, Seat Connections.

**UNIT 3 : Tension Members & Compression Members**

(6 L)

Types of Tension Members, Net and effective Sectional Areas, Types of Failure, Design Strength and design of Tension Member, Lug Angles, Splices, Gusset Plate. Effective Length and Slenderness Ratio of compression members, Classification of Cross Sections, Column Formula, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Encased Column, Column Splices, Design of Column Bases and Caps

**UNIT 4 : Flexural Members**

(8 L)

Structural behaviour of Beams, Types of Sections for flexural design Lateral Stability of Beams, Lateral Torsional Buckling, Plastic design of beams, Design of Laterally Supported Unsupported Beams Rolled Beams, Built-Up Beams, Lintels, Purlins, Bearing Plates, Design of Beam-columns

**UNIT 5 : Plate Girders**

(8 L)

Elements of Plate Girder, General considerations, Proportioning of web, Proportioning of flanges, Design methods, End panel design, Design of Stiffeners, Curtailment of Flanges

**UNIT 6: Gantry Girders & Industrial Buildings**

(6 L)

(a) Gantry Girders:-Introduction, Loads, Fatigue Effects, Design of gantry Girders.

(b) Industrial Buildings: - Introduction, Planning, Structural Framing, Types, Roof and Side Coverings, Elements of an Industrial Building, Design Steps of Industrial Building

**References:**

1. Design of Steel Structures by N. Subramanian, Oxford University Press
2. Design of Steel Structures by K.S.Sai Ram, Pearson India Education Pvt. Ltd.
3. Design of Steel Structures by S. K. Duggal, Tata Mcgraw Hill.
4. Steel Structures by Robert Englekirk. Hohn Wiley & sons inc.
5. Structural Steel Design by Lambert Tall, Ronald Press Comp. New York

## CONSTRUCTION PLANNING & MANAGEMENT

CE-17102

CREDIT:3

3-0-0

### UNIT 1: Construction Engineering Systems:

An Over View-Brief introduction to construction projects - magnitude and critical considerations. Principles and process of management, Managerial role of engineers. Project cycle. Resources involved in construction projects. Classification of projects, Modeling of construction projects for managerial controls using bar charts, milestone charts, and network diagrams. Resource quantification. 8(L)

### UNIT 2: Network Techniques and LOB-

Deterministic and probabilistic networks, CPM, PERT, PDM and GERT. Critical path evaluation, cost planning and resource allocation through network techniques. Project monitoring and controls, Line of balance technique. 7(L)

### UNIT 3: Engineering Economics & Construction Contracts and Delivery Methods-

Time value of money, Present economy studies, Equivalence concept, financing of projects including PPP, economic comparison, Depreciation and break even cost analysis. Contract management legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts. Managing contracts and disputes. 7(L)

### UNIT 4: Construction Procedures-

Tenders and tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract, extra items, settlements of disputes, arbitration and commissioning of project. 5(L)

### UNIT 5: Construction Equipment Management-

Different types of construction equipments viz. Excavating, Hauling, Lifting and Concreting equipments, Scrapers. Cost of owning and operating, economic life of equipment, factors influencing performance of equipment, Rolling resistance, Coefficient of traction, Rimpull, drawbar pull. Safety during mechanized construction. Time motion studies. 6(L)

### UNIT 6: Application of Optimization Techniques in Construction Planning & Management and Software Applications.

Application of Linear Programming Techniques to construction project management, Transportation and Assignment Models in construction management. Decision making under risk – Decision tree concept, MS Project and Primavera Project Planner. 8(L)

### References :

1. Charles, Patrick. "Construction Project Planning and Scheduling", Pearson Education.
2. Peurifoy R.L., and Schexnayder, Clifford J., Construction Planning", Equipment and Methods, T.M.H., International Book Company.
3. Panneerselvam, R., Engineering Economics, Prentice- Hall of India Private Limited New Delhi.
4. Wiest, Jerome D., and Levy Ferdinand K., A management Guide to PERT/ CPM: with GERT/PDM/DCPM and other Networks. - Hall of India Private Limited New Delhi.
5. Seetharaman, S., Construction Engineering and Management, Umesh Publications New Delhi.
6. Taha, Hamdy A., Operations Research – An Introduction , Prentice- Hall of India Private Limited New Delhi ( 2006).



## WATER RESOURCES ENGINEERING - I

CE-17103

CREDIT: 3

3-0-0

### UNIT 1 : General Considerations-Water Requirement of Crops

(10 L)

Definition, Scope of subject, Advantage, Lift and flow irrigation, Development of irrigation in India, crops season, Important crops, Functions of water in plant growth, Soil moisture, consumptive use of water, Irrigation frequency, irrigation methods.

### UNIT 2 : Canal Irrigation

(6 L)

Classes of irrigation canal, Parts of a canal system, Preliminary survey, Detailed survey, Commanded areas, Channel alignment, Curves, Assessment of water requirement, Channel losses, Kennedy's Theory, Lacey's Theory, Longitudinal section, Schedule of area statistics and channel dimension cross- section of irrigation channel.

### UNIT 3 : Water-Logging

(5 L)

Definition, Effect, Causes and Anti-water logging measure, concrete lining, shotcrete lining, Asphaltic lining, Brick tile lining of earth material, Sections of lined channel. Drainage of Water logged land, Types of Drains, Open Drains, Closed Drains, Spacing of closed Drains.

### UNIT 4 : Regulation and Control of Canal System

(5 L)

Definition, requirement and classes of outlets, Non-modular outlet, Semi-module, Rigid module, Selection of outlet. Regulation, Measurement of discharge, Assessment of canal Revenue, Efficient Management of irrigation water.

### UNIT 5 : Hydrologic Analysis and Design

(12 L)

Hydrologic statistics-probabilistic treatment of hydrologic data, frequency and probability functions, statistical parameters, probability distribution of hydrologic variables; Frequency analysis- extreme value distributions, flood frequency analysis, risk and reliability; Hydrologic design-design scale and level, safety factors and safety margins; uncertainty analysis.

### References :

1. Singh, Dr. Bharat - *Fundamentals of Irrigation Engineering*, Nem Chand and Bros.
2. Varshney, Dr. R.S., Gupta & Gupta - *Theory and Design of Irrigation Structures Vol. I & II.*, Nem Chand and Bros.
3. Punamia, Dr. B.C. and Pandey B.B. Lal, *Irrigation and Water Power Engineering*, Laxmi Publications(Pvt)Ltd.
4. Bedient and Huber- *Hydrology and Flodplain Analysis*, Prentice Hall.
5. Ojha, C.S.P. , Bhunya, P. and Berndtsson, R.- *Engineering Hydrology*, Oxford University Press Canada.
6. Todd and Mays- *Groundwater Hydrology*, John Wiley and Sons, Inc.
7. K. Subramanya - *Engineering Hydrology*, Tata McGraw Hill Education Pvt.Ltd.
8. Modi, P.N. – *Irrigation Water Resources and Water Power Engineering*, Standard Book House
9. Asawa, G.L. – *Irrigation and Water Resources Engineering*, New Age International.
10. Walker, W.R. and Skogerboe, G.V. 1986. *Surface irrigation theory and practice*. Prentice- Hall, Inc.

## **STEEL STRUCTURES DETAILING (LAB.)**

**CE-17201**

**CREDIT: 2**

**0-0-3**

### **List of Practical:**

1. General detailing lay- out, details of steel sections and symbolic representation of connections.
2. Detailing of simple and moment resistant bolted and welded connections.
3. Detailing of trusses:
  - a) Using Angle sections, Tee sections, Channel sections and I-sections
  - b) Using tubular sections
4. Detailing of beam and column splicing & built-up columns.
5. Detailing of beam and column connection using bolts and welds.
6. Detailing of column and footing connection using bolts and welds.
7. Detailing of Plate girder.
8. Detailing of Gantry girder.

## VII-Semester

### Professional Elective –I

#### ADVANCED CONCRETE TECHNOLOGY

**CE-17301**

**CREDIT:4**

**3-1-0**

**Unit1. Introduction:** Different types of cementitious materials, Admixtures and Construction Chemicals: Benefits of admixtures, type of admixtures, action of plasticizers and super-plasticizers, doses of super plasticizers, super plasticizers-cement compatibility, waterproofing admixture, antibacterial and similar admixtures. 8(L)

**Unit 2. Strength of Concrete:** Factors affecting the strength, curing of concrete, autogenous healing, strength in tension, failure in compression, failure under multi-axial stress, micro cracking, aggregate cement paste interface, effect of age on strength of concrete, relationship between compressive and tensile strength, bond between concrete and reinforcement, temperature effects in concrete. 8(L)

**Unit 3. Durability of Concrete:** Causes of inadequate durability, transportation mechanism in concrete, diffusion, absorption, water permeability of concrete, air and vapour permeability, carbonation, acid attack on concrete, sulphate attack on concrete, efflorescence, effect of sea water on concrete, alkali-silica reaction, chloride attack, factors affecting corrosion of reinforcement, type of cracking. 10(L)

**Unit 4. Special Concrete:** Light weight concrete, mass concrete, roller compacted concrete, Polymer concrete, High strength concrete, High performance concrete, Self compacting concrete. 6(L)

**Unit 5. Non-destructive Testing of Hardened Concrete:** Rebound hammer test, pull-out test, ultrasonic pulse velocity test, resonant frequency method. 4(L)

**Unit 6: Fracture Mechanics and its Application in Concrete:** Linear elastic fracture mechanics, Concrete fracture mechanics, Fracture process zone. 4(L)

#### References :

1. Mehta, P.K. & Monterio P.J. “ Concrete Microstructure , Properties and Materials”, TMH New Delhi
2. Lea, F.M., “The Chemistry of Cement and Concrete”, Arnold London
3. Neville A.M., *Properties of Concrete*, Pitman Publishing Company.
4. Shetty M.S. “Concrete Technology, Theory and Practices.” S. Chand & Company Ltd., New Delhi.
5. Gambhir M.L. “Concrete Technology” - Tata McGraw Hill Publishing Company Ltd., New Delhi.

## BRIDGE ENGINEERING

**CE-17302**

**CREDIT:4**

**3-1-0**

**UNIT 1: General Introduction-**

Site selection, various types of bridges and their suitability, loads, forces, IRC bridge loading and permissible stresses. 7(L)

**UNIT 2: Culvert Design-**

Theory of force calculation in bridge slabs, Design of RC & PC culverts. 7(L)

**UNIT 3: RC/PC Bridges Types-**

Introduction to design of box culvert, box girder and other RC/PC bridges types. 4(L)

**UNIT 4: T-beam Bridges Design-**

Theory of load distribution in girders. Detailed design of RC/PC T-beam bridge. 11(L)

**UNIT 5: Cable Stayed Bridges-**

Introduction to cable stayed bridges and its analysis. 4(L)

**UNIT 6: Bearing, Substructures and Foundations-**

Introduction to design of bearing, abutments, pier and pier cap and foundation. 5(L)

**References :**

1. *Design of bridges- N. Krishna Raju , Oxford & IBH Publication Co. Pvt. Ltd.*
2. *Plain & Reinforced Concrete – O.P. Jain , Nemchand, Roorkee.*
3. *Concrete Bridge Practice, Analysis, Design & Economics– Tata Mcgraw hill*
4. *Essential of Bridge Engineering – D.J. Victor , Oxford & IBH publication Co.*

## FINITE ELEMENT AND FINITE DIFFERENCE METHODS

**CE-17303** **CREDIT:4** **3-1-0**

**UNIT 1. Introduction** **04(L)**

Brief introduction to numerical methods.

**UNIT 2. Different Approaches** **06(L)**

Direct method, Energy approach, Integral formulations and Variational methods.

**UNIT 3. Modeling** **06(L)**

Interpolation functions, Numerical integration and modeling considerations.

**UNIT 4. Applications** **12(L)**

Finite element analysis of 1-D and 2-D problems.

**UNIT 5. Applications and Error Analysis** **06(L)**

Application of the method to the axisymmetric and 3-D bodies, Finite element error analysis.

**UNIT 6. Finite Difference Method** **06(L)**

Application of the finite difference method for 1-D and 2-D problems

### References :

1. *K. J. Bathe & E. L. Wilson, Numerical Methods in Finite Element Analysis, Prentice-Hall, Englewood Cliffs, N. J., 1976.*
2. *R. D. Cook, Concepts and Applications of Finite Element Analysis, John Wiley, New York, 2001.*
3. *C. Zienkiewicz and R. L. Taylor, Finite Element Method, Butterworth Heinemann publication, 3rd Edition, 2005.*
4. *Thomas J. R. Hughes, The Finite element method, Dover Publications, 2nd Edition, 2000.*
5. *T. R. Chandupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 5th Reprint, 1999.*
6. *J. N. Reddy, An Introduction to Linear Finite Element Method, Oxford University Press, Oxford, 2004.*

## STRUCTURAL DYNAMICS

**CE-17304**

**CREDIT:4**

**3-1-0**

**UNIT 1: Response of Single Degree Freedom Systems-**

Free and Forced vibrations of single degree freedom system. Response to harmonic, periodic, impulsive and general dynamic loading. 7(L)

**UNIT 2: Response of Multi Degree Freedom Systems-**

Two degree and multi-degree-freedom systems. Free vibration of lumped multi degree of freedom system. 9(L)

**UNIT 3: Vibration of Distributed Systems-**

Vibration of continuous Beams, Lagrange's equation and its application. 6(L)

**UNIT 4: Structural Control –**

Base Isolation, Damper and Concept of structural control 6(L)

**UNIT 5: Random vibrations-**

Random vibrations response. 5(L)

**UNIT 6: Soil Structure Interaction and Code Provision-**

Use of IS-1893 in Earthquake Resistant Design. Dynamics of soil structure interaction. 7(L)

**References :**

1. *Introduction to Structural Dynamics - J.M. Biggs, McGraw-Hill Companies*
2. *Engineering Vibrations - L.S. Jacobsen & R.S. Ayre, McGrawHill Book Co., New York*
3. *Structural Dynamics - Theory & computation - Mario Paz, Springer, 1997.*
4. *Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra, Pearson/Prentice Hall.*
5. *Structural dynamics - R. Roy Craig Jr, Wiley, 1981.*
6. *Dynamics of structures - R. W. Clough and J Penjien. McGraw-Hill, Inc.*

## ROCK ENGINEERING

**CE-17305** **CREDIT:4** **3-1-0**

**UNIT 1: Rock Engineering-**

Rock Mechanics, Different types of Rocks, Stress and Infinitesimal strain. 4(L)

**UNIT 2: Classification of Rock and Rock Masses-**

Engineering classification of rocks and rock masses. Strength and Modulus from Classifications. 6(L)

**UNIT 3: Rock Strength and Deformability-**

Rock strength and failure criteria, Intact rock and rock masses properties, initial stresses in rock and their measurements, Stress-Strain models. 7(L)

**UNIT 4: Rock Foundation-**

Estimation of Bearing Capacity in Intact and Fractured Rocks, Bearing Capacity of Pile / Pier in Rocks. 9(L)

**UNIT 5: Drilling and Blasting For Underground and Open Excavations-**

Operational Planning, Explosive Materials, Blast Design, Controlled Blasting Techniques. 8(L)

**UNIT 6: Shotcreting-**

Shotcrete; Purpose, Methods, Mix Design and Testing. 5(L)

**References :**

1. *B. Singh and R.K. Goel: Rock Mass Classification, Elsevier.*
2. *Brady and E.T. Brown: Rock Mechanics for Underground Mining, George Allen & Unwin (Publishers) Limited.*
3. *Vutukuri, Lama and Saluja: Handbook on Mechanical Properties of Rock, Trans Tech Publications.*
4. *E. Hoek and J. Bray: Rock Slope Engineering, Taylor and Francis*
5. *T. Ramamurthy: Engineering in Rocks, PHI Learning Private Limited*
6. *Rock Slope Engineering: E. Hoek and J. Bray*

## ADVANCED WASTEWATER TREATMENT

**CE-17306**

**CREDIT:4**

**3-1-0**

### **UNIT 1: Introduction-**

Introduction to Advanced Wastewater Treatment: Need, Various Technologies Used, Unit Operations and Unit Processes and their combination. 5(L)

### **UNIT 2: Removal of Refractory and Dissolved Organics-**

Adsorption, Adsorption Isotherms, Design of Adsorption systems; Microfiltration and membrane bioreactor. 5(L)

### **UNIT 3: Removal of Dissolved Inorganic Substances-**

Chemical Precipitation, Ion Exchange, Reverse Osmosis. Electro dialysis, Membrane Filtration Processes, Gasstripping, Advanced oxidation processes & Distillation, Disinfection. 8(L)

### **UNIT 4: Nutrients Removal-**

Nitrogen – sources and forms, Nitrification & de-nitrification processes, Phosphorous – Sources, Forms, Chemical and Biological Methods of treatment for nutrients. 6(L)

### **UNIT 5: Kinetics-**

Immobilised cell technology, Comparison of different techniques, Enzymes & Microbial cell Immobilisation, Effect of Immobilisation on growth Kinetics. Immobilised cell reactors – types, design criteria & applications. 7(L)

### **UNIT 6: Re-Use of Water-**

Wastewater reclamation, wastewater reuse & recycle applications. 5(L)

### **References :**

1. *Manual on Sewerage and Sewage Disposal CPHEEO, Govt. of India.*
2. *S.R. Quasim, Design of Wastewater Treatment, CBS Publications, U.S.A.*
3. *Metcalf & Eddy, Wastewater Engineering, Tata-McGraw Hill.*
4. *Fair, Geyer and Okin, Water and Wastewater Engineering Vol. II, John Wiley & Sons.*
5. *S.J. Acreivala, Dekker & Mercel Wastewater Treatment for Pollution Control, Tata McGraw Hills.*
6. *Davis, Introduction to Environmental Engineering, McGraw Hills International.*



## DESIGN OF WATERSUPPLY AND TREATMENT SYSTEMS

**CE-17307** **CREDIT:4** **3-1-0**

**UNIT 1: Water Quality-**

Water quality parameters and standards, quality of water in various resource pools. 5(L)

**UNIT 2: Unit Operation-**

Unit operations and processes flow sheets for water treatment, 6(L)

**UNIT 3: Settling Tanks-**

Design of settling basins, mixing devices and flocculation tank 6(L)

**UNIT 4. Filtration -**

Design of Filtration and disinfection units, 5(L)

**UNIT 5: Miscellaneous Treatment-**

Water softening, Ion exchange, Adsorption etc. 6(L)

**UNIT 6: Distribution Networks-**

Analysis and design of water supply distribution networks. 7(L)

**References :**

1. *Manual on Water Supply and Treatment, CPHEEO, Govt. of India*
2. *Manual on Sewage & Sewage Distribution, CPHEEO, Govt. of India*
3. *Peavy, Rowe & Tchobanoglous, Environmental Engineering, McGraw Hill Publication*
4. *Fair, Geyer and Okin, Water and Wastewater Engineering Vol. I & II, John Wiley & Sons.*
5. *S.R. Qasim, Water Supply treatment plant design, CBS Publications, U.S.A.*
6. *S.R. Qasim: Design of wastewater Treatment, CBS Publications, U.S.A.*

## TRAFFIC ENGINEERING

**CE-17308**

**CREDIT:4**

**3-1-0**

### **UNIT 1: Introduction To Traffic Engineering-**

Definition and Scope of Traffic Engineering, Functions, Organization and Importance of Traffic Engineering. Elements of Traffic Engineering: Vehicular, Driver and Road Characteristics. 4(L)

### **UNIT 2: Traffic Flow Parameters –**

Traffic flow parameters: volume, density, speed and related terms, Relationship between various parameters, Study and analysis of vehicle arrivals, headways, and gap acceptance in traffic flow. Highway Capacity and Level of Service, Codal Provisions for roadway capacity in urban and non-urban areas. 8(L)

### **UNIT 3: Traffic Flow Theory-**

Fundamental diagrams of traffic flow theory, Macroscopic and Microscopic traffic flow models Queuing theory and its practical applications in traffic engineering problems, Traffic Data Analysis, Software application for traffic flow modeling and simulation. (10L)

### **UNIT 4: Traffic Studies-**

Traffic survey: Speed studies, journey time and delay studies; traffic volume studies, vehicle classified count and occupancy; origin-destination studies, parking studies, Emerging Traffic Surveillance Technologies 6(L)

### **UNIT 5: Traffic Safety**

Introduction, Significance, Accident Studies, Collision Diagrams, Condition Diagrams, Assessment of Accident Data, Measures for Improving Traffic Safety, Road Safety Audits 6(L)

### **UNIT 6: Traffic Control-**

Definition, functions and importance of traffic control. Methods of traffic control: Traffic signs, Road Markings, and other traffic controls aids, roadway lighting, Traffic Regulation, Intersection control and design of traffic signals. 8(L)

### **References :**

1. *Traffic Engineering* by L.R. Kadiyali , Khanna Publishers.
2. *Highway Engg* by S.K. Khanna and C.E.J. Justo, Nem Chand Publication
3. *Principles of Transportation Engineering* by P. Chakravorhy and Animesh Das, PHI Learning Private Limited.
4. *Transportation Engineering: An Introduction* by C. Jotin Khisty, B. Kent Lall, PHI Learning.
5. *Traffic engineering* by R. P. Roess, E. S. Prassas, and W. R. McShane, Pearson.
6. *Introduction to Traffic Engineering* by R. S. Kumar, Universities Press.
7. *Relevant IS and IRC Codes*

## TRANSPORTATION SYSTEM AND PLANNING

**CE-17309**

**CREDIT:4**

**3-1-0**

**UNIT 1: Introduction** -The fields of transportation system, Transportation system engineering, Transportation organizations. Role of Transportation, Social, Economical, Political and Environmental. 4(L)

**UNIT 2: Transportation Planning Process**-Elements of Transportation Planning, Goals and objectives, Identification of needs, generation of alternatives, evaluation of alternatives, Implementation of alternatives. 6(L)

**UNIT 3: Land-Use Transportation System**-Components of transportation system, Urban Transportation System, Land use and Transportation, land-use forecasting and land-use plans, Lowry-type transportation/Land use model. 7(L)

**UNIT 4: Transportation Survey**-Study area definition, Zoning, Home interview surveys, Road-side Interview surveys, Inventory of Transport Facilities, Inventory of Land use and Economic Activities, Expansion of data from samples. 8(L)

**UNIT 5: Travel Forecast and Trip Distribution Models**- Overview of Forecasting Process, Urban Activity Forecast, Trip Generation Models, multiple linear regression analysis, Category analysis methods of Trip Distribution: Uniform Factor method, Average Factor method, Fratar method, Furnace method, Gravity models, Intervening Opportunity model, Destination Choice models, Entropy model. 7(L)

**UNIT 6: Mode Choice and Traffic Assignment Models** -Logit models for mode choice, All or nothing assignment models, Incremental assignment models, user equilibrium models. 6(L)

### References :

1. *Introduction to Transportation Engineering – William W Hay.*
2. *Introduction to Transportation Engineering Planning- E.K. Mortak.*
3. *Metropolitan Transportation Planning – J.K. Dickey*
4. *Priciples of Transportation Engineering- Partha Chakroborty and Animesh Das*

## ENGINEERING HYDROLOGY

**CE-17310**

**CREDIT:4**

**3-1-0**

### **UNIT 1: General Consideration-**

Introduction, Definition, Hydrologic cycle.

4(L)

### **UNIT 2: Precipitation and Abstractions-**

Precipitation, Infiltration and Evapo-transpiration, Forms of precipitation, measurement, depth-area-duration and intensity-duration frequency relations, Evaporation - process, measurement, and estimation, Infiltration process, measurement, and estimation, Evapo-transpiration measurement and estimation, Runoff and Hydrographs, Rainfall Runoff correlations, Flow duration curve, Mass curve, Stream Flow measurements, Droughts and floods.

10(L)

### **UNIT 3: Hydrograph-**

Factors affecting flow hydrograph, Unit hydrograph, its analysis, and S-curve hydrograph, Synthetic and instantaneous unit hydrographs.

6(L)

### **UNIT 4: Floods-**

Statistical analysis, Flood frequency studies, Flood forecasting, Rational method, Time Area curves, Risk, reliability, and safety factor, Flood control measures.

8(L)

### **UNIT 5: Flood Routing-**

Introduction to basic routing equations, Design flood, Channel and flood routing, Hydrologic Routing, Hydraulic routing.

6(L)

### **UNIT 6: Groundwater Hydrology-**

Groundwater hydrology, Flow equations and Numerical solutions, Confined and unconfined flow, Well hydraulics Steady and unsteady flow, Well losses, Specific capacity, Groundwater recharge, Groundwater quality and Groundwater monitoring network.

### **References :**

1. *Bedient and Huber- Hydrlogy and Flodplain Analysis, Prentice Hall.*
2. *Ojha, C.S.P. , Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University Press Canada.*
3. *Todd and Mays- Groundwater Hydrology, John Wiley and Sons, Inc.*
4. *K. Subramanya - Engineering Hydrology, Tata McGraw Hill Education Pvt.Ltd.*
5. *Modi, P.N. – Irrigation Water Resources and Water Power Engineering, Standard Book House*
6. *Asawa, G.L. – Irrigation and Water Resources Engineering, New Age International.*

## VII-Semester

### Open Elective–I

#### WASTE MATERIAL MANAGEMENT

**CE-17501**

**CREDIT:3**

**3-0-0**

**Pre-requisite:** *Nil*

**UNIT 1. Waste Materials & their Composition**

**08(L)**

Introduction - global material and energy consumption patterns. comparison between the United States, Europe and India. Quantity and composition of wastes. Relevance of waste recycling in the modern world.

**UNIT 2. Energy Conservation**

**05(L)**

Energy conservation and fuel production by reprocessing organic/inorganic wastes.

**UNIT 3. Recovery of Materials**

**08(L)**

Recovery of materials from municipal, agricultural and industrial wastes e.g. Iron & steel, aluminium. Other non-ferrous metals. glass paper, plastics, rubber, leather, textiles, biomass and flyash etc.

**UNIT 4. Waste Disposal Techniques**

**05(L)**

Methods of waste disposal - Land fill, Incineration. composting etc.

**UNIT 5. Waste-to-Energy Conversion**

**08(L)**

Technologies of waste-to-energy conversion - Pyrolysis to liquid and gaseous fuels, anaerobic digestion to CH<sub>4</sub>, Refuse derived solid fuels and their calorific values, heat recovery incineration etc.

**UNIT 6. Case Studies**

**06(L)**

Case studies of operating plants using waste-to-energy conversion technologies, economic analysis and implementation, techniques of waste processing plants.

**References:**

1. "Solid Waste Conversion to Energy" by Alter harvey & Dunn J.J., Published by Marcel Dekker. 1980.
2. "Handbook of solid waste management" by Frank Kreith and George Tchobanoglous, McGraw Hill, 2002.
3. "Resources and references: hazardous waste and hazardous materials management" by Gayle Woodside and Dianna S. Kocurek, William Andrew Publishing, 1996.

## ENVIRONMENTAL IMPACT ASSESSMENT

**CE-17502**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

### **UNIT 1. Introduction**

**05(L)**

Environment and its components, Concept of Ecological imbalances, carrying capacity and sustainable development.

### **UNIT 2. EIA Procedure**

**05(L)**

Introduction to Environmental impact Analysis, EIA procedure, A step-by-step procedures for developing EIA. Notification of EIA by MoEF, Environmental impact Statement. Elements of Environmental Analysis.

### **UNIT 3. Methodologies**

**08(L)**

Impact Assessment Methodologies,-Matrices, overlays, network analysis. Battle system, Geographic Information System (GIS), Cost-Benefit Analysis, etc.

### **UNIT 4. Air and Water Quality Impact Analysis**

**05(L)**

Brief Introduction of Air Quality Impact analysis. General Approach for Assessment of Air Pollution Impact, Introduction of Water Quality Impact Analysis.

### **UNIT 5. Noise and Human Health Quality Impact Analysis**

**06(L)**

Introduction of Noise quality impact analysis and energy impact analysis. Introduction of Socio-Economic and Human Health Impact Analysis.

### **UNIT 6. Environment Laws**

**05(L)**

Brief introduction about Environment legislation and Environmental Audit. Case studies of EIA of developmental projects.

### **References:**

1. *Environmental Impact Assessment* by C.W. Canter, Tata McGraw-Hill publication
2. *Environmental Impact Assessment Methodologies* by Y. Anjaneyulu & V. Manickam, BS Publication
3. *Environmental Impact Assessment Theory and Practice* by Peter Wathern, Routedge-Taylor & Francis Group.
4. *Environmental Impact Assessment-A guide to Best Professional Practice* by Charles H. Eccleston, CRS Press
5. *Manual on Environmental Impact Assessment, Ministry of Environment & Forest (MoEF), Govt. of India.*

## ELEMENTS OF CIVIL ENGINEERING

**CE-17503**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

**UNIT 1. Civil Engineering and Infrastructural Development**

**06(L)**

Introduction, Role of civil Engineer, Infrastructural development, Impact of Infrastructural Development, Vastu.

**UNIT 2. Materials**

**08(L)**

Properties, Principles and uses of Traditional materials, Stone, Brick, Timber, Mortar and Concrete, Alternate materials, Composite materials, Smart materials.

**UNIT 3. Surveying**

**08(L)**

Introduction to conventional methods of surveying and instruments to prepare map/plan, Introduction to modern surveying methods and instruments.

**UNIT 4. Building Construction, Design and Services**

**08(L)**

Introduction to functional and structural elements of buildings. Functional planning of building, Damp proofing, Sound proofing and Heat insulation of buildings.

**UNIT 5. Geotechnical Investigations**

**04(L)**

Geotechnical considerations for engineering projects, Sub-soil investigations.

**UNIT 6. Environmental Engineering**

**06(L)**

Water Demand, Waste Water, Solid waste disposal, Environment Pollution: sources, measurement and mitigation.

**References:**

1. *Building Materials*, S.K. Duggal, IV<sup>th</sup> Ed, New Age Publisher.
2. *Surveying Vol. 1+2*, 3<sup>rd</sup> Ed., S.K. Duggal, Tata McGraw Hill, New Delhi.
3. *Building Technology evaluation*, TTI Publication, Chandigarh.
4. *Geotechnical Engineering*, P.R. Arora, Standard Publisher, New Delhi.
5. *Environmental Engineering Vol. I* S.K. Garg, Khanna Publisher, New Delhi.
6. *Environmental Engineering*, Peavy, Rowe, G. Tachobanglous, McGraw Hill International Edition, New Delhi.

## ELEMENTS OF REMOTE SENSING

**CE-17504**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** *Nil*

### **UNIT 1. Basic Concepts of Remote Sensing**

**06(L)**

Remote sensing- introduction, Physics of remote sensing- electromagnetic radiations and their characteristics, Thermal emissions, Multi-concept in remote sensing,

### **UNIT 2. Remote Sensing System**

**10(L)**

Remote sensing satellites and their data products. Sensors and orbital characteristics, Spectral reflectance curves for earth surface features, Methods of remotely sensed data interpretation- Visual interpretation, Concept of FCC.

### **UNIT 3. Introduction to Advanced Remote Sensing techniques**

**04(L)**

Basic principles and analysis techniques of thermal, hyperspectral and microwave sensing, LIDAR.

### **UNIT 4. Photogrammetry**

**06(L)**

Fundamentals, vertical and tilted photographs, relief and tilt displacements, strip triangulation, Flight planning, parallax calculation.

### **UNIT 5. Applications of Remote Sensing**

**06(L)**

Applications of remote sensing in Natural resources management, Environmental impact assessment and water resources management.

### **UNIT 6. Digital Image Processing**

**10(L)**

Digital image and its characteristics, satellite data formats, Image rectification and restoration, Image Enhancement- Contrast Manipulation, Spatial Feature Manipulation, Multi-image manipulation, Image Classification- Unsupervised and Supervised Classification, Classification Accuracy, Details of digital image processing software packages.

### **References:**

1. *Remote Sensing and Image Interpretation* by Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, 6<sup>th</sup> Edition, Wiley, 2006.
2. *Surveying* by S. K. Duggal, Volume 2, 3<sup>rd</sup> Edition, 2009.
3. *Remote Sensing of the Environment* by John R. Jensen, Pearson Education, 2009.
4. *Introduction to Remote Sensing* by James B. Campbell and Randolph H. Wynne, Fifth Edition, Guilford Press, 2011.
5. *Remote Sensing and GIS* by Basudeb Bhatta, Oxford University Press, 2011.



## VIII-Semester

### EARTHQUAKE RESISTANT DESIGN

**CE-18101** **CREDIT:4** **3-1-0**

**UNIT 1: Response of Single-Degree-Freedom Systems-**

Introduction to Seismology. Response of Structure to Earthquake motion, Modeling of structures, Dynamics of single degree of freedom system. 7(L)

**UNIT 2: Response of Multi-Degree-Freedom Systems-**

Dynamics of multi degree of freedom system, Idealization of structures, Dynamics of soils and seismic response. Response spectra method, Time history method 8(L)

**UNIT 3: Concept of Structural Design-**

Conceptual design, Analysis of single and multi storey frame, Equivalent lateral force method. 7(L)

**UNIT 4: Design of Reinforced Concrete Buildings-**

Design of Reinforced Concrete buildings. 7(L)

**UNIT 5: Design of Masonry and Steel Buildings-**

Design of Masonry buildings, Steel Buildings and non structural element, Material Properties, Code provisions. 5(L)

**UNIT 6: Design of Non-Structural Element and Structural Control-**

Design of non structural element. Concept of base isolation and structural control. 6(L)

**References :**

1. *Introduction to Structural Dynamics - J.M. Biggs, McGraw-Hill Companies.*
2. *Earthquake Resistant of Design of structures, S.K.Duggal, Oxford University Press.*
3. *Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran, Sarita Prakashan.*
4. *IS: 1893 – 2002, Criterion for Earthquake Resistant Design.*
5. *Fundamental of Earthquake Engineering -N.M. Neumarks and E. Rosenblueth, Prentice Hall, Inc. Englewood Cliffs, N.Y., 1971*
6. *Engineering Vibrations - L.S. Jacobsen & R.S. Ayre, McGrawHill Book Co., New York*
7. *Structural Dynamics - Theory & computation - Mario Paz, Springer, 1997.*
8. *Dynamics of Structures Theory and Applicaions to Earthquake Engineering - Anil K.*
9. *Chopra, Pearson/Prentice Hall.*
10. *Structural dynamics - R. Roy Craig Jr, Wiley, 1981.*
11. *Dynamics of structures - R. W. Clough and J Penjien.McGraw-Hil, Inc.*

## WATER RESOURCES ENGINEERING – II

**CE-18102**

**CREDIT:4**

**3-1-0**

### **UNIT 1: Principles of Design of Canal Masonary Works-**

Types of Masonry work, Principle of design, BLIGH'S Theory, Khosla's theory for determination of pressure and exit gradient, Hydraulic jump. 7(L)

### **UNIT 2: Canal Regulation Works and Cross Drainage Works-**

Falls, Classification of falls, Design of falls, Distributory head regulator and cross-regulator, Escape, Bed bars. Necessity and types, Aquaduct, Syphon Aquaduct, Super passage, Canal syphon, Level crossing, Design of cross drainage work. 7(L)

### **UNIT 3: Canal Head Works-**

Canal Head Works-Functions, Location, Layout of Head work, Weir, Canal head regulator, Design of Weirs on permeable foundation, silt control at headwork. 7(L)

### **UNIT 4: River Training Planning of Dams & Reservoirs-**

Objective, scope & classification of river & river training, stages, Methods of River Training, bank protection. Selection of Dam sites, Investigation, Estimation of storage capacity, Principle of Reservoir planning. Flood Routing, Reservoir loss, Reservoir sedimentation. 7(L)

### **UNIT 5: Types of Dams and Their Characteristics-**

Gravity Dams, Forces acting, method of analysis, Modes of failure and factors of safety, Elementary Profile of a gravity dam, Stability analysis, galleries. Earth dam, Foundation, Materials, Criteria for safe design, typical sections, compaction of Rock fill dam. spillway, spillway capacity, Types of spillway, Energy dissipation below spillway, Gates. 10(L)

### **UNIT 6: Water Power-**

Hydro-Electric Power: Assessment of potential, Classification of power plants, Types of turbine, Powerhouse. 4(L)

### **References :**

1. Singh, Dr. Bharat - *Fundamentals of Irrigation Engineering*, Nem Chand and Bros.
2. Varshney, Dr. R.S., Gupta & Gupta - *Theory and Design of Irrigation Structures Vol. I & II.*, Nem Chand and Bros.
3. Punamia, Dr. B.C. and Pandey B.B. Lal, *Irrigation and Water Power Engineering*, Laxmi Publications(Pvt)Ltd.
4. Modi, P.N. – *Irrigation Water Resources and Water Power Engineering*, Standard Book House
5. Bedient and Huber- *Hydrology and Floodplain Analysis*, Prentice Hall.
6. Asawa, G.L. – *Irrigation and Water Resources Engineering*, New Age International.
7. Walker, W.R. and Skogerboe, G.V. 1986. *Surface irrigation theory and practice*. Prentice- Hall, Inc.

## VIII-Semester

### Professional Elective –II

#### ADVANCED CONCRETE DESIGN

**CE-18301**

**CREDIT:4**

**3-1-0**

**UNIT 1: Building Frames-**

Introduction to building frames, Substitute method of frame analysis, Portal frame method, Cantilever method. 8(L)

**UNIT 2: Grid Floors-**

Analysis and design of grid floors. 4(L)

**UNIT 3: Bunker and Silo-**

Introduction, Difference between Bunker and Silo, Design of bunker and Silo. 8(L)

**UNIT 4: Chimney-**

Analysis and design of chimneys. 6(L)

**UNIT 5: Folded Plates and Shells-**

Analysis and design of folded plates. 6(L)

**UNIT 6: Overhead Tanks-**

Circular overhead tank, I.S. code method, Intz Tank (Membrane Analysis). 8(L)

**References :**

1. *N.Krishna Raju :Advanced Reinforced Concrete Design, CBS Publishers, New Delhi*
2. *M.L.Gambheer: Design of Reinforced Concrete Structures, PHI Learnig Private Limited New Delhi.*
3. *B.C.Punmia: Reinforced Concrete Design, Standard Publishers Distributers, New Delhi*
4. *S.S.Bhavikatti, Advance R.C.C. Design, New Age International Publishers, New Delhi*
5. *P. Dayaratnam: Design of Reinforced Concrete Structures.*

## CONSTRUCTION EQUIPMENT AND TECHNIQUES

**CE-18302**

**CREDIT:4**

**3-1-0**

**UNIT 1: Imperatives of Mechanized Construction** -General considerations, specifications, types of drives, classification of equipment, efficiency and performance evaluation criteria of equipment, terminology relating to equipment and machine. Sources of equipment cost of owning and operating of equipment, economic life of equipment, time motion study. 10(L)

**UNIT 2: Construction Equipment**-Excavating, hauling, loading and unloading equipment. Earthmovers, soil compacting equipment, and pile driving equipment. Hoists and cranes. Details and applications of composite equipment viz. power shovel, dragline, clamshell, backhoe, scraper etc. Concrete producing equipment, Ready mixed concrete plants, transit mixers and vibrators. Equipment for dredging, trenching, tunneling, drilling, blasting, dewatering and pumping equipment. Safety in construction. 6(L)

**UNIT 3: Building Construction Practices**-Building construction: Site clearance, earthwork, shallow and deep building foundations, masonry construction water and damp proofing, flooring, joints. Temporary works viz. form work centering and shuttering. Slip forms, steel trusses. 7(L)

**UNIT 4: Sub Structure Construction** -Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls, cofferdams. Piling, well and caisson sheet piles, shoring for deep cutting. 7(L)

**UNIT5:Super Structure Construction**-Launching girders ,bridge decks, offshore platforms, in-situ prestressing in high rise structures, aerial transporting handling, erection of transmission towers. Construction sequences in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges -Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks. 7(L)

**UNIT6:Repair and Rehabilitation**- Study on causes of building damage and deterioration–Assessment to materials and methods of repair and restoration such as grouting, jacketing, use of rebar fasteners etc. 3(L)

### References :

1. Jha J and Sinha S.K., *Construction and Foundation Engineering*, Khanna Publishers, 1993.
2. Sharma S.C., “*Construction Equipment and Management*”, Khanna Publishers New Delhi.
3. Deodhar, S.V., “*Construction Equipment and Job Planning*”, Khanna Publishers, New Delhi.
4. Varma, M., “*Construction Equipment and its Planning and Application*”, Metropolitan Book Company, New Delhi..
5. Stuart Wood J. R. - *Heavy construction equipment and methods*, Prentice Hall Englewood Cliffs, New Jersey.
6. Peuritoy, R. L. - *Construction Planning equipment and methods*, McGraw Hills International Book Company.
7. Russel, J. F. - *Construction equipment*, Metropolitan Book Co. Delhi.

## PLASTIC DESIGN OF STEEL STRUCTURES

**CE-18303**

**CREDIT:4**

**3-1-0**

**UNIT 1:** Introduction, Historical review, plastic failure, plastic moment, Behaviour of cross section, capacity of a cross- section, shape factor, concept of load factor, factors affecting Plastic Collapse. 5(L)

**UNIT 2:** Plastic Hinge, Collapse Mechanisms, Analysis and Design of beams and frames, Gable frames. 6(L)

**UNIT 3:** Semi Graphical method and Mechanism method. 5(L)

**UNIT 4:** Plastic moment distribution for multi-storey and multi-bay frames. 5(L)

**UNIT 5:** Analysis for deflections at collapse. Effect of axial force and shear, Second order effects. 6(L)

**UNIT 6:** Minimum Weight Design. 5(L)

### References :

1. *Plastic Analysis of Structures* by P G Hodge, McGraw Hill
2. *Plastic Analysis and Design of steel structures* by M Bill Wong
3. *Limit State Design of Steel Structures* by S.K.Duggal, Tata McGraw hill

**ADVANCED FOUNDATION DESIGN**

**CE-18304**

**CREDIT:4**

**3-1-0**

**UNIT 1: Foundation Components-**Components of foundation, Classification of foundation, Geotechnical Design Parameters. 5(L)

**UNIT 2: Shallow Foundation in Clay-** Footings in Clay; Bearing Capacity and Settlement, Design of Rafts in Clay, Floating raft-Design. 7(L)

**UNIT 3: Shallow Foundation in Sand-** Geotechnical Design of Isolated, Raft and Combined footing in Sand, 8(L)

**UNIT 4: Pile Foundations-** Load transfer through Piles, Piles in Clay and Sand, Test load on Piles, Pile Driving Formulae, Analysis of pile groups in sand & clay, Laterally loaded and Battered pile. 8(L)

**UNIT 5: Well Foundation-**Types of well foundation, Grip length, Well sinking, Measures for Rectification of Tilts and Shift, Analysis for well. 7(L)

**UNIT 6: Foundations on Expansive Soils-**Identification of Expansive Soils, Consequences of Swelling, Design of Foundations in Expansive soils, Modification of Expansive Soils. 7(L)

**References :**

1. Tomilson: *Foundation Design and Construction*, Pitman.
2. J. E. Bowles: *Foundation Analysis and Design*, McGraw-Hill.
3. Swami Saran: *Analysis and Design of Sub structure*, oxford and IBH publishing company pvt. ltd.
4. Kaniraj: *Design Aid in Soil Mechanics and Foundation Engineering*, Tata McGraw-Hill
5. Kurian: *Design of Foundation System*, Narosa Publishing House

## SOIL DYNAMICS

**CE-18305**

**CREDIT:4**

**3-1-0**

**UNIT 1: Earthquake and its Effect-**Introduction. Site seismicity, Seismic soil response, Design earthquake parameters. 5(L)

**UNIT 2: Vibrations-**Elementary vibrations, Free & Forced vibration with and without damping of single degree freedom system, Two degree freedom system. 5(L)

**UNIT 3: Dynamic Soil Properties-**Properties of Soil and its Evaluation, Behavior of Soil Properties due to Dynamic loads. 9(L)

**UNIT 4: Liquefaction-**Mechanism of Liquefaction, Liquefaction factors, Evaluation of Liquefaction, Anti-liquefaction measures. 7(L)

**UNIT 5: Dynamic Earth Pressure-**Nature and Magnitude of Earth Pressure, Modified Coulomb's Theory of Earth Pressure, Modified Culmann's Graphical Earth Pressure. 6(L)

**UNIT 6: Dynamic Bearing Capacity-**Bearing capacity, Settlement, Tilt and horizontal displacement of shallow foundations under dynamic load. 8(L)

### References :

1. *Shamsher Prakash: Soil Dynamics, McGraw-Hill*
2. *Barkan: Soil Dynamics, McGraw-Hill*
3. *S.L. Kramer: Geotechnical Earthquake Engineering, Pearson Education*
4. *P. J. Moore: Analysis and Design of Foundation for Vibration: Taylor & Francis*
5. *Das & Ramana: Principles of Soil Dynamics, Cengage Learning*

## AIR POLLUTION AND CONTROL

**CE-18306**

**CREDIT:4**

**3-1-0**

**UNIT 1: Introduction**-History of Air Pollution, Atmosphere-its structure and composition, Major Air pollutants-their sources and effects in quality criteria and Ambient air quality standard. 6(L)

**UNIT 2: Photo- Chemistry of Atmosphere**-Photo-Chemical reactions, Monatomic oxygen and ozone formation, role of oxides of Nitrogen, Hydrocarbons and oxidants in photochemical smog; Oxidation of SO<sub>2</sub> in polluted atmospheres. 6(L)

**UNIT 3: Meteorology and Air Pollution**-Atmospheric stability and inversions, mixing height-plume behaviour, effluent dispersion theories, Isokinetic sampling, Modeling, Gaussian and other models, Effective stack height 6(L)

**UNIT 4: Control of Particulate**-Particulate distribution, collection efficiency, Settling and Deposition. Particulate collection mechanisms, and control equipments. Filters, gravitational, centrifugal-multiple type cyclones, wet collectors, Electrostatic Precipitation. 7(L)

**UNIT 5: Control of Gasses and Vapors**-Adsorption and absorption processes, Carbon Monoxide emission control, Incineration or after-burning processes, control of oxides of sulphur and oxides of nitrogen, General control methods, flue gas control. 7(L)

**UNIT 6: Automobile Pollution**-Automobile emissions and their control methods. Automobile emission standards. Legislation and regulatory trends: Air pollution laws, standards, their implementation and compliance. 6(L)

### References :

1. Peavy, Rowe & Tchobanoglous, *Environmental Engineering*, McGraw Hill Publication
2. Richard w. Boubel et al, " *Fundamentals of Air Pollution* ", Academic Press, New York.
3. Noel de Nevers, " *Air Pollution control Engg.* ", McGraw-Hill, New York.
4. M. N. Rao et al, " *Air Pollution* ", Tata McGraw Hill.
5. C. Stern " *Fundamentals of Air Pollution* " Academic Press Inc.



## DESIGN OF WASTE WATER SYSTEM

**CE-18307**

**CREDIT:4**

**3-1-0**

**UNIT 1: Wastewater Characteristics** -Wastewater characteristics, Priority pollutants in Wastewater.  
5(L)

**UNIT 2: Unit Operations**-Unit operations and processes, Reactor Analysis, Continuity Equation, Analysis of Ideal and field reactors.  
7(L)

**UNIT 3: Biological Treatment Processes-I** Process Flow sheets, Theory and Design of biological treatment processes like activated sludge process and its modifications  
6(L)

**UNIT 4: Biological Treatment Processes-II** Trickling filter, Aerated lagoons and oxidation ditches,  
6(L)

**UNIT 5: WS, WSP & RBC**-Waste stabilization ponds, and rotating biological contactors  
6(L)

**UNIT 6: Anaerobic Treatment Processes**-Principle of anaerobic treatment, Design of septic tanks, Anaerobic treatment of sludges and its disposal,  
6(L)

### References :

1. *Manual on Sewerage and Sewage Disposal CPHEEO, Govt. of India.*
2. *S.R. Quasim, Design of Wastewater Treatment,, CBS Publications, U.S.A.*
3. *Metcalf & Eddy, Wastewater Engineering, Tata-McGraw Hill.*
4. *Fair, Geyer and Okin, Water and Wastewater Engineering Vol. II, John Wiley & Sons.*
5. *S.J. Acreivala, Dekker & Mercel Wastewater Treatment for Pollution Control, Tata McGraw Hills..*

## RURAL ROADS

**CE-18308**

**CREDIT:4**

**3-1-0**

**UNIT 1: Rural Road Planning**-Introduction -Concept, Objective and Significance of rural roads for Developing Countries, Rural Road Planning and Investment -State of Art, Existing practices for Rural Road Planning, PMGSY Models, Accessibility Based Models. 8(L)

**UNIT 2: Geometric Design Planning**-Geometrics of low cost rural roads -traffic and design speed, Horizontal alignment, Vertical alignment and Cross-section elements. 5(L)

**UNIT 3: Pavement Design**-Pavement design: CBR method of Rural Road Design as adopted in PMGSY programme, IRC method of pavement design for rural roads. 7(L)

**UNIT 4: Materials and Construction Techniques**-Materials for low cost roads -Stabilized techniques, various construction techniques for sub-base, base and surface courses; soil tests for construction of rural roads. 6(L)

**UNIT 5: Rural Road Drainage and Cross Drainage Structures**-Road Drainage -Various Low Cost Drainage Alternatives for rural roads. Types of cross drainage structures for rural roads: Hume pipe, slab culverts and cause ways, Preparation of detailed estimates for rural road. 6(L)

**UNIT 6: Rural Road Maintenance**-Maintenance -Various Type of Maintenance, Low Cost Maintenance Management Techniques. 8(L)

### References :

1. Barwell, I., Edmonds, G.A., Howe, J.D.G.F. and De Veen, J., *Rural Transport in 1989. Developing Countries, Intermediate Technology Publications, U.K., 1985.*
2. *Document of Rural Road Development in India, Vol I & II, Central Road research Institute, New Delhi, 1990.*
3. *Manual for Rural Road design and specifications, Ministry of Rural Development, Govt. of India.*

## OPEN CHANNEL HYDRAULICS

**CE-18309**

**CREDIT:4**

**3-1-0**

**UNIT 1: General Considerations**-Classification, description, types energy and momentum equation for prismatic and non prismatic channels. 6(L)

**UNIT 2: Uniform Flow**-Uniform flow, critical flow, critical depth, specific energy. Channel transitions, Energy-depth relationships, uniform flow computations, Manning's coefficient, Compound Channels 8(L)

**UNIT 3: Gradually Varied Flow**- Gradually varied flow, dynamic equation, flow profiles and computation, analytical and graphical methods, transitions of subcritical and supercritical flows. 6(L)

**UNIT 4: Rapidly Varied Flow**-Characteristics of the flow, hydraulic jump in horizontal, and sloping channels, submerged hydraulic jump, Flow in channel of non-linear alignment and non-prismatic channel sections. 6(L)

**UNIT 5: Spatially Varied Flow**- Basic principles, dynamic equation, analysis of flow profile, methods of numerical integration. 6(L)

**UNIT 6: Unsteady Flow and Flow in Mobile Boundary Channel**-Introduction to unsteady flow, continuity and momentum equations, Finite difference techniques for open channel problems, bed forms, channel resistance, sediment loads. 8(L)

### References :

1. Barwell,.I., Edmonds, G.A., Howe, J.D.G.F. and De Veen, J., *Rural Transport in 1989. Developing Countries, Intermediate Technology Publications, U.K., 1985.*
2. *Document of Rural Road Development in India, Vol I & II, Central Road research Institute, New Delhi, 1990.*
3. *Manual for Rural Road design and specifications, Ministry of Rural Development, Govt. of India.*

## ADVANCED GEOLOGICAL AND GEOPHYSICAL INVESTIGATIONS

**CE-18310**

**CREDIT:4**

**3-1-0**

**UNIT 1:**

4(L)

Geological studies of outcrop in different types of terrain. Lithological and structural analysis of outcrop. Introduction to different geological laboratory methods.

**UNIT 2:**

8(L)

Megascopic properties of rocks and their analysis for stability of civil structures. Concept of Polarising Trinocular Optical Microscope, optical properties and application. Microscopic properties of rocks and their importance in characterisation of rock aggregates. Optical estimation of alkali silica reaction and petrographic evaluation of concrete.

**UNIT 3:**

6(L)

Concept of Geological strength Index, Rock Mass Rating and their importance for Jointed rocks. Rock Quality Designation for massive rocks. Structural and lithological analysis of rocks and outcrops for identification of suitable site for Construction of Dam and Tunnel.

**UNIT4:**

3(L)

Concept of Overburden, its identification and importance for foundation. Overburden investigation through Electrical Resistivity Survey and Ground Penetrating Radar. Borehole electrical logging concept, methodology and importance.

**UNIT 5:**

4(L)

Case studies of rock aggregate analysis for concrete. Case studies for textural and mineralogical study and its implication for selection of building material. Case studies related to structural and geotechnical implications for tunnel and Dam.

**UNIT6:**

3(L)

Characterisation of gemstone and its application. Identification of decorative building stones for their sustainable development and exploration. Indian distribution of rock aggregates and gemstone.

**References:**

- Barry Saltzman ,Advances in Geophysics,Academic Press
- Phillip Kearey, Michael Brok, Ian Hill ,An Introduction to Geophysical Exploration, Blackwell Science
- Robert F.Legget, Geology and Engineering,,Mc-Graw Hill
- F.G.Well, Engineering Geology and Geotechniques,Author: F.G.Well ,Elsevier Ltd.
- William Morris Davis, Instruction in Geological Investigation,University of Chicago Press
- W.M.Telford, L.P.Geldart R.E.Sheriff, Applied Geophysics,Cambridge University Press
- S.K.Duggal, H.K.Pandey, N Rawal,Engineering Geology,Mc-Graw Hill

## VIII-Semester

### Professional Elective –III

#### MATRIX ANALYSIS OF STRUCTURES

**CE-18401**

**CREDIT:4**

**3-1-0**

**UNIT 1: Analysis of Space Truss**-Space Truss, General, Stiffness matrix of a member, Equilibrium of a joint, axial force in a member, illustrative example. 6(L)

**UNIT 2: Analysis of Grids**- Grid, general, stiffness matrix of a member, joint equilibrium conditions, member forces, torsion constant, examples. 5(L)

**UNIT 3: Analysis of Space Frames**-Space Frame, general, stiffness matrix of a member, Rotation matrix, joint equilibrium conditions, fixed end reactions, member forces, and examples. 6(L)

**UNIT 4: Additional Topics**- Stiffness method as a variational approach, strain energy, potential of loads, total potential energy, minimum potential energy theorem, loaded members, equilibrium equations and energy minimization conditions, interpolation and shape functions, member stiffness matrix using displacements, equivalent joint loads using shape functions, introduction to finite element method, triangular element for plane stress, exercises. 8(L)

**UNIT 5: Nonlinear Analysis**-Linear and non linear response , secant and tangent stiffness matrices , error in equilibrium , Non linear analysis, incremental load method, direct iteration method, Newton –Raphson method, modified Newton –Raphson method. 8(L)

**UNIT 6: Nonlinear Analysis of Truss** -Error vector , Nonlinear behaviour of a truss , nonlinear analysis of a truss. 7(L)

#### References :

1. *Matrix Methods of Structural Analysis*, A. Kassimali, Cengage Learning.
2. *Matrix Methods of Structural Analysis*, A S Meghre , Charotar Publishing.
3. *Matrix Methods of Structural Analysis*, Wang , C. K. , International Text Book Company.
4. *Matrix Methods of Structural Analysis*, Przemieniecki , J. S. , Courier Dover Publication.

## PRECAST AND MODULAR CONSTRUCTION PRACTICES

**CE-18402**

**CREDIT:4**

**3-1-0**

**UNIT 1: Fundamentals of Industrialized Construction Systems**-Introduction and Overview of reinforced and prestressed concrete construction. 3(L)

**UNIT 2: Design Principles of Precast/Prefabricated Structure Components**-Materials for construction of precast elements, Design and detailing of precast/prefabricated building components, Structural design and detailing of joints in prefabricated structures, consideration of handling stresses. 8(L)

**UNIT 3: Precast Concrete Construction**-Production of ready mixed concrete, quality assurance, equipments in precast prefabricated structures. 7(L)

**UNIT 4: Economic Evaluation for Precast Modular Concrete Construction**-Productivity analysis, Economics of form work, Design of formwork and their reusability. 7(L)

**UNIT 5: Modular Construction Practices**-Modular construction: Evolution & Practices, Fibonacci series, Golden Section and other reliable proportioning concepts. Modular construction practices in building construction. 8(L)

**UNIT 6: Modular Coordination & Standardization**-Modular coordination, Standardization, systems building, limitations and advantages of modular construction. Codal recommendations relating to modular construction. 8(L)

### References :

1. Gerwick, B. C. Jr. and Gerwick., "Construction of Prestressed Concrete Structures", Wiley Interscience.
2. Smith R. E. – Prefab architecture: a Guide to modular design and construction, John Wiley and Sons.
3. Staib, G., Darrhafer, A. and Rosenthal, M. "Components and Systems- Modular Construction Design, Structure, New Technologies" Birkhauser publisher
4. Precast Concrete in Mixed Construction: State-of-art report, FIB Bulletin, International Federation for Structural Concrete (fib) .
5. NBC 2005 , Bureau of Indian Standard, New Delhi

## PRESTRESSED CONCRETE

**CE-18403**

**CREDIT:4**

**3-1-0**

**UNIT 1: Over-View**-Over-view of basic concept of prestressing, materials for prestressed concrete, prestressing systems, losses of prestress, Analysis of Prestress, Pressure line or Thrust line, Concept of load balancing, stresses in tendons, Cracking moment. 6(L)

**UNIT 2 : Deflection and Flexure**-Importance of control deflection, Short term deflections of uncracked members, Prediction of long time deflections, deflections of cracked members, Types of flexural failure, Different methods of estimating flexural strength, Shear resistance of Prestressed concrete members. 10(L)

**UNIT 3 : Anchorage Zone Stresses and Limit State Design Criterion**-Stress distribution in end block of post-tensioned members, Investigations on Anchorage zone stresses and anchorage zone reinforcement, Limit state design criteria for prestressed concrete members, principles of dimensioning prestressed concrete members. 6(L)

**UNIT 4 : Design of Prestressed Concrete Sections**-Design of prestressed concrete sections for flexure, axial tension, compression & bending, shear & torsion, bond and bearing, Design of pretensioned, post-tensioned and partially prestressed members. 8(L)

**UNIT 5 : Continuous Prestressed Concrete Beams**-Analysis and Design of Continuous Prestressed Concrete Beams , Application of Prestressed Concrete in Bridges. 6(L)

**UNIT 6 : Pole and Sleeper**- Design of Pole and Sleeper 4(L)

### References :

1. *Theory of Prestressed Concrete*, Michael Chi & frank A. Biberstein, Prentic Hall International, London
2. *Prestressed Concrete Theory and Practice*, P.B.Morice & E.H.Cooley, Sir Isaac Pitman & Sons, Ltd. London.
3. *Modern Prestressed Concrete*, James R. Libby, Van Nostrand Reinhold Company New York.
4. *Prestressed Concrete*, N.Rajgopalan, Narosa Publishing House, New Delhi.
5. *Prestressed Concrete*, N. Krishna Raju, Tata McGraw Hill, Publishing Company Limited New Delhi.

## EARTH AND EARTH RETAINING STRUCTURES

**CE-18404**

**CREDIT:4**

**3-1-0**

**UNIT 1: Earth and Rock Fill Dams**-Types of Dams, Materials, Foundation. 5(L)

**UNIT 2: Stability Analysis**-Slope-Stability Analysis, Seepage through Earth dam with Different Sloping face, Requirement and Safety of Earth dams, Stability of Slopes under different conditions. 8(L)

**UNIT 3: Design of Retaining Walls**-Types of Retaining Walls, Design of Gravity, Cantilever and Counterfort Retaining walls. 7(L)

**UNIT 4: Sheet Piles**-Types of Sheet Piles, Design of Free Cantilever, Cantilever and Anchored Sheet Piles. 7(L)

**UNIT 5: Braced Cuts and Cofferdams**-Sheeting and Bracing System, Design of Bracing, Types of Cofferdams, Design of Cofferdams in Soil. 7(L)

**UNIT 6: Shaft, Tunnels and Underground Conduits**-Stresses in Soil around Shaft and Tunnels, Design of Underground Conduits; Ditch, Positive Projected, Negative Projected, Imperfect and Tunneled Conduits. 7(L)

### References :

1. *Sherard: Earth and Rockfill Dams, J. Wiley and Sons*
2. *Bharat Singh and Sharma: Earth and Rockfill Dams, Sarita Prakashan.*
3. *V.N. S. Murthy: Soil Mechanics and Foundation Engineering, CBS Publishers & Distributors Pvt Ltd.*
4. *Christian Kutzner: Earth and Rockfill Dams, Taylor & Francis*
5. *Robert B. Jansen: Advanced dam engineering for design, construction, and rehabilitation, Springer*



## GEOTECHNICAL PROCESSES

**CE-18405**

**CREDIT:4**

**3-1-0**

**UNIT 1: Soil Stabilization**-Soil Stabilization Techniques; Mechanical, Lime, Cement, Bituminous, Chemical, Thermal, Electrical stabilization. 7(L)

**UNIT 2: Compaction**-Field and Laboratory compaction, Properties of soil on wet and dry of OMC, Compaction control, Precompaction, Compaction piles. 6(L)

**UNIT 3: Dewatering**-Dewatering Methods; Interceptor Ditches, Single and multi-stage well points, Vacuum Well points, Electro-osmosis, Vertical drains. 9(L)

**UNIT 4: Grouting**-Grouting materials; Suspension, Solutions and Resins, Grouting technology. 6(L)

**UNIT 5: Geosynthetics**-Types of Geosynthetics, Geotextile testing, Application of Geosynthetic material, Bearing Capacity improvement. 7(L)

**UNIT 6: Reinforced Earth**- Mechanism of reinforced earth, Soil reinforcement, Design of reinforced earth wall. 5(L)

### References :

1. *Hausman: Engineering Principles of Ground Modification, McGraw-Hill*
2. *Leonards: Foundation Engineering, McGraw-Hill*
3. *Witerkorn & Fang: Foundation Engineering, Springer*
4. *F.G. Bell: Foundation on Difficult Ground, Newnes-Butterworth*
5. *Shroff: Grouting Technology in Tunnelling and Dam Construction, A A Balkema Publishers*
6. *Ingles and Metcalf: Soil Stabilization, Wiley.*

## RURAL WATER SUPPLY AND SANITATION

**CE-18406**

**CREDIT:4**

**3-1-0**

**UNIT 1: Water Supply**-Water Supply, Nature of the Problem, Sources locating a well, Construction of a Dug-well and Drilled Tubewell. 6(L)

**UNIT 2: Water lifting Arrangements**-Water-lifting arrangements, Hilly Areas, lakes and ponds. 5(L)

**UNIT 3: Treatment**-Treatment in Rural Water Supplies, Sanitation, Choosing Waste Disposal Techniques, 7(L)

**UNIT 4: Wastewater Disposal**-Excreta Disposal and Techniques for Reusing, Waste Disposal and Reuse, 5(L)

**UNIT 5: Onsite Collection & Treatment**-On-Site collection and Disposal, pit latrines, Compositing privy, Septic Tanks and Aquaprivy. 6(L)

**UNIT 6: Offsite Collection & Treatment**-Collection and off Site Treatment, Cartage, waterborne ponds, Composting, Aquatic weeds, Reuse, Irrigation, Aquaculture, Algae, Fertilization and Biogas. 6(L)

### References :

1. *Manual on Water Supply and Treatment - CPHEEO Govt. of India.*
2. *Excreta Disposal for Rural Areas and Small Communities. Wagner, Lanoix, WHO Publication.*
3. *Small Community water supplies - Holkef (ed.), John Wiley & Sons.*

## SOLID WASTE MANAGEMENT

**CE-18407**

**CREDIT:4**

**3-1-0**

**UNIT 1: Introduction**-Waste generation, major legislation, monitoring responsibilities, sources and types of solid waste - sampling and characterization, and properties of solid waste. Determination of composition of MSW- storage and handling of solid waste. 6(L)

**UNIT 2: Collection Systems**-Collection Systems, Alternative techniques for collection system. Separation, Processing and Transportation of Solid Waste: 6(L)

**UNIT 3: Separation & Recovery**-Unit operations used for separation and processing, Materials Recovery, Waste transformation through combustion and anaerobic composting, anaerobic methods for materials recovery and treatment - Energy recovery – Incinerators, RDF, etc. 7(L)

**UNIT 4: Transfer and Transport**- Transfer and Transport: Means and methods, Types and design of transfer station. Landfills: Site selection, design and operation, drainage and leachate collection systems - requirements and technical solutions, designated waste landfill remediation - Integrated waste management facilities. 7(L)

**UNIT 5: Hazardous Wastes** -Hazardous wastes - sources and characteristics, regulations, minimization & Compatibility, handling, storage, collection and transport of hazardous waste. 6(L)

**UNIT 6: Hazardous Waste Treatment Technologies**-Hazardous waste treatment technologies - Design of operation facilities, Solidification, chemical fixation and encapsulation, incineration. Hazardous waste landfills: Site selection, design operation & remediation of hazardous waste disposal sites. 7(L)

### References :

1. *Manual on Municipal solid waste management, CPHEEO, Govt. of India*
2. *G. Technobanglous, H. Theisen and S. A. Vigil, Integrated Solid Waste Management. McGraw-Hill International Publication*
3. *Masataka Hanashima, Modern Landfill Technology and Management; Proceedings of the Asian Pacific Landfill Symposium, Fukuoka, Japan, Oct. 11-13, 2000.*
4. *Integrated Solid Waste management: A Lifestyle Inventory by P. White, M. Franke and P. Hindle (Chapman & Hall)*
5. *Iqbal H. Khan and naved Ahsan, A Text Book of Solid Waste Management, CBS Publishers.*
6. *Manoj Datta, Waste disposal in engineered landfills, Narosa Publishing House*

## TRANSPORT ASSET MANAGEMENT

|   |                 |              |
|---|-----------------|--------------|
| <b>CE-18408</b>   | <b>CREDIT:4</b> | <b>3-1-0</b> |
| <b>UNIT 1: Introduction-</b> Transport Infrastructure: Roads, Railways and Airways  |                 | 4(L)         |
| <b>UNIT 2: Asset Management-</b> Asset Management Concept, Management Systems: Components, objectives, designs, role.   |                 | 6(L)         |
| <b>UNIT 3: Measures of Performance-</b> Defining performance, common characteristics of infrastructure, alternative approaches.   |                 | 6(L)         |
| <b>UNIT 4: Condition Assessment Techniques-</b> Condition assessment, alternative technologies, for assessing condition including surface and subsurface condition, and the limitations of technologies   |                 | 7(L)         |
| <b>UNIT 5: Transport Economics-</b> Parameters used in Transport economic analysis, Life Cycle Cost Analysis, Cost and benefit components in Transportation Systems, Economic Evaluation of Transportation Project.   |                 | 7(L)         |
| <b>UNIT6:</b><br><b>GISBasedAssetManagementSystems:</b> Techniquesandimportanceofinventories,GISasadataintegrationand analytic tool, Diagnostics and data, The collection and use of data, Discussion of the use of data., example application for road and rail infrastructure management. |                 | 10(L)        |

### References :

1. "Measuring and Improving Infrastructure Performance," National Academy Press, Washington DC 1995
2. Grigg, Neil, "Infrastructure engineering and management," Wiley, 1988. (On reserve in library)
3. Haas, Hudson, Zaniewski, *Modern Pavement Management*, Krieger, Malabar, 1994.
4. Hudson, Haas, Uddin, *Infrastructure management : integrating design, construction, maintenance, rehabilitation, and renovation*, McGraw Hill, 1997. (On reserve in library)
5. Munnell, Alicia, Editor, *Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June 1990*. (On reserve in library)
6. *World Development Report 1994: Infrastructure for Development*
7. Chakroborty, P. and Das A., *Principles of Transportation Enineering*, Prentice Hall of India, New Delhi 2003

## WATER RESOURCES SYSTEMS MANAGEMENT

CE-18409

CREDIT:4

3-1-0

**UNIT 1: General Considerations**-Introduction, Global and National scenario of water availability, Economics of Water Resources Systems: principles of engineering economics; Projected water needs for drinking, agriculture and other uses, National water policy. 6(L)

**UNIT 2: River Basins**-River basins of India and Inter Basin transfer of water, Run off and rainfall data of basins, Interstate and Inter National level sharing of water. 6(L)

**UNIT 3: Water Power**-Water power, its relation with irrigation and other needs, water power potential and estimation, Storage of water - Current storage scenario in India. Sedimentation, evaporation and other related problems like location of storage sites and rehabilitation problems, etc. 8(L)

**UNIT 4: Irrigation and Hydraulic Structures** -Broad Principles of Hydraulic structures and canal systems, Floods and draughts, drainage, water logging, soil salinity and soil conservation problems. 8(L)

**UNIT 5: Introduction to Mathematical Optimization**-Optimization Techniques; Application of Optimization techniques; Water Resources Planning under uncertainty; Stochastic Planning models; Application of Simulation models. 6(L)

**UNIT 6: Water Related Environmental Problems**-Water related environmental problems, Water pollution, ground water and river pollutions etc., Water conservation measures. 6(L)

### References :

1. *Water Resources systems- Vedula and Mujumdar, Tata McGraw-Hill.*
2. *Bedient and Huber- Hydrlogy and Flodplain Analysis, Prentice Hall.*
3. *Ojha, C.S.P. , Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University Press Canada.*
4. *Todd and Mays- Groundwater Hydrology, John Wiley and Sons, Inc.*
5. *K. Subramanya - Engineering Hydrology, Tata McGraw Hill Education Pvt.Ltd.*
6. *Modi, P.N. – Irrigation Water Resources and Water Power Engineering, Standard Book House*
7. *Asawa, G.L. – Irrigation and Water Resources Engineering, New Age International.*

## REMOTE SENSING IN CIVIL ENGINEERING

**CE-18410**

**CREDIT:4**

**3-1-0**

**UNIT 1: Introduction**-Definition of terms, space and airborne imageries, characteristics of photographic images, colour, tone and texture. 4(L)

**UNIT 2: Photo Interpretation**-Techniques of photo-interpretation, Special equipment, photo-interpretation keys, Ground truth collection and verification, photo-interpretation for selection of Civil Engineering project sites such as for buildings, Railways and highways etc. 6(L)

**UNIT 3: Introduction to Remote Sensing**-Principles of Remote Sensing and platform for remote sensing, different platform, sensor combinations. Multi concept in remote sensing through visible and other bands spectral signals 6(L)

**UNIT 4: Digital Image Processing**-Digital image processing- Digital image and its characteristics, satellite data formats, Image rectification and restoration, Image Enhancement- Contrast Manipulation, Spatial Feature Manipulation, Multi-image manipulation, Image Classification- Unsupervised and Supervised Classification. 10(L)

**UNIT 5: Remote Sensing Image Interpretation and its application**-Different methods of remotely sensed data interpretation, Application of Remote sensing in land use and land cover analysis, water resources management, flood zoning and damage estimation, pollution studies, regional planning 8(L)

**UNIT 6: Engineering Survey Using Remote Sensing**-Survey of natural resources and engineering works, Remote sensing satellite and their data products. 8(L)

### References:

1. *Remote Sensing and Image Interpretation* by Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, 6th Edition, Wiley, 2006.
2. *Surveying* by S. K. Duggal, Volume 2, 3rd Edition, 2009.
3. *Remote Sensing of the Environment* by John R. Jensen, Pearson Education, 2009.
4. *Introduction to Remote Sensing* by James B. Campbell and Randolph H. Wynne, Fifth Edition, Guilford Press, 2011.
5. *Remote Sensing and GIS* by Basudeb Bhatta, Oxford University Press, 2011.

## VIII-Semester

### Open Elective – II

#### FUNDAMENTALS OF GIS & GPS

**CE-18501**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

**UNIT 1: Basic Concepts of GIS**

**06(L)**

Introduction, Essential components of a GIS, Data acquisition- Scanners and Digitizers, Raster and Vector formats, Data editing, Geo-referencing.

**UNIT 2. Data Modelling and Analysis in GIS**

**07(L)**

Real world problem solving and spatial Analysis, Database Query, Overlay Operations, Buffer Analysis, Digital Terrain Modelling, Data output.

**UNIT 3. GIS Software and Applications**

**07(L)**

Introduction to various GIS packages, Applications of GIS in natural resource management, land use planning, environmental management and impact analysis, disaster management, transportation planning etc.

**UNIT 4. Introduction to GPS**

**08(L)**

Introduction, Satellite navigation System, GPS satellite constellation, Space segment, Control segment, User segment.

**UNIT 5. GPS Signal Structure, Receiver and Errors**

**06(L)**

GPS signal, Receivers and their types, GPS errors.

**UNIT 6. Surveying using GPS**

**06(L)**

Position and time from GPS, Static, Kinematic and Differential GPS.

**References:**

1. *Fundamentals of Geographic Information System* by Kang-Tsung Chang, Tata Mcgraw-Hill (TMH), 4th edition, 2009.
2. *Surveying* by S. K. Duggal, Volume 2, 3<sup>rd</sup> Edition, 2009.
3. *GPS: Principles and Applications* by A. Ganesh and R. Narayanakumar, Satish Serial Publishing House, Delhi, 2006.
4. *Fundamentals of GPS* by PLN Raju., URL: <http://www.wamis.org/agm/pubs/agm8/Paper-7.pdf>
5. *GPS Basics*, Leica Geosystems, URL: [www.geoplane.com/gpsbasics.pdf](http://www.geoplane.com/gpsbasics.pdf).
6. *Basics of the GPS Technique: Observation Equations* by Geoffrey Blewitt., URL: [http://www.nbmj.unr.edu/staff/pdfs/Blewitt Basics of gps.pdf](http://www.nbmj.unr.edu/staff/pdfs/Blewitt%20Basics%20of%20gps.pdf).

## WATER RESOURCES MANAGEMENT

**CE-18502**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

### **UNIT 1. General Considerations**

**06(L)**

Introduction of the subject, Global and National scenario of water availability, Projected water needs for drinking, agriculture and other uses, National water policy.

### **UNIT 2. River Basins**

**06(L)**

River basins of India and Inter Basin transfer of water, Inter-state and International level sharing of water.

### **UNIT 3. Water Power**

**08(L)**

Water power, its relation with irrigation and other needs, water power potential and estimation, Storage of water - Current storage scenario in India. Sedimentation, evaporation and other related problems like location of storage sites and rehabilitation problems, etc.

### **UNIT 4. Irrigation And Hydraulic Structures**

**08(L)**

Broad Principles of Hydraulic structures and canal systems, Floods and draughts, drainage, water logging, soil salinity and soil conservation problems.

### **UNIT 5. Groundwater**

**06(L)**

Ground Water - Its hydrology, conjunctive uses etc. and ground water rules, groundwater quality, sea water intrusion.

### **UNIT 6. Water Related Environmental Problems**

**06(L)**

Water related environmental problems, Water pollution, ground water and river pollutions etc., Water conservation measures.

### **References:**

1. *Bedient and Huber- Hydrlogy and Flodplain Analysis, Prentice Hall.*
2. *Ojha, C.S.P. , Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University Press Canada.*
3. *Todd and Mays- Groundwater Hydrology, John Wiley and Sons, Inc.*
4. *K. Subramanya - Engineering Hydrology, Tata McGraw Hill Education Pvt.Ltd.*
5. *Modi, P.N. – Irrigation Water Resources and Water Power Engineering, Standard Book House*
6. *Asawa, G.L. – Irrigation and Water Resources Engineering, New Age International.*
7. *Walker, W.R. and Skogerboe, G.V. 1986. Surface irrigation theory and practice. Prentice-Hall, Inc.*



## REGIONAL AND URBAN PLANNING

**CE-18503**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

**UNIT 1. Introduction**

**03(L)**

Definition. Theories in urban and regional planning. Efficiency measures, Planners skills. Planning processes and continuity of planning process. Visual representation for planning purposes.

**UNIT 2. Regional Planning**

**07(L)**

Integrated Area planning in India. Distribution and sizes of settlements. Factors Affecting regional planning, regional surveys and preparation of regional plans.

**UNIT 3. Urban-Planning**

**07(L)**

Factors affecting urban growth, town plans and local surveys. Planning for utilities, services and civil amenities.

**UNIT 4. Transportation Planning**

**08(L)**

Urban Travel Characteristics, Goals and Objectives, planning agencies, legislation, Travel Demand Models, Transportation System Impacts and Traffic Impact Analysis, System Costs, User Costs, Environmental Costs, Urban Transit Planning.

**UNIT 5. Standards and Design**

**07(L)**

Service design and networking, settlement and habitat, Open space land use planning, Integrated rural planning schemes.

**UNIT 6. Development**

**06(L)**

Control and Planning Organisation, Development Control legislation. Master Plans, Growth of urban complexes.

**Reference:**

1. *Urban and Regional Planning in India* - by K.V. Sundaram. Vikash Publishing House Pvt. Ltd.
2. *Town and Country Planning* by Lewis Kuble.
3. *The Urban Pattern* - by A.B. Gallion.

## OPERATIONS RESEARCH

**CE-18504**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

### **UNIT 1. Introduction**

**06(L)**

History of operations research. Nature and scope of operations research. Allocation, assignment and transportation models. Construction and solution of those models.

### **UNIT 2. Linear Programming**

**08(L)**

Introduction. Mathematical formulation of the problem. Graphical solution. Mathematical solution of linear programming problem. Slack and surplus variables. Matrix formulation of general linear programming problem.

### **UNIT 3. Simplex Method**

**10(L)**

Fundamental properties of solution of extreme points. Computational procedures. Artificial variables. Two phase simplex method. Unrestricted variables. Problems of degeneracy. Principle of duality in Simplex method. Sensitivity analysis.

### **UNIT 4. Integer Programming**

**03(L)**

Formulation and solution of Integer programming problems.

### **UNIT 5. Game Theory**

**03(L)**

Introduction, Two persons zero sum games. The maximin and minimax principles. Reduction of game problem to L.P.P.

### **UNIT 6. Transportation. Assignment Models & Inventory Management**

**08(L)**

Matrix forms of transportation and assignment problems, Initial basic feasible solutions. Transportation algorithm. Degeneracy in transportation problem. Initial and optimum assignment through Assignment Models. Inventory classification, EOQ Model and Inventory Control.

### **References:**

1. Taha, H. A., *Operations Research – An Introduction*, Prentice Hall of India Private Ltd., New Delhi, 6<sup>th</sup> Edition, 1997.
2. Rao S. S., *Optimization Theory and Application*, John Wiley & Sons., New Delhi, 1<sup>st</sup> Edition, 1996.
3. Hillier F. S. and Lieberman G. J., *Introduction to Operations Research*, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3<sup>rd</sup> Edition, 1980.
4. Wagner, H. M., *Principles of Operations Research with Application to Managerial Decisions*, Prentice Hall of India Private Ltd., New Delhi, 2<sup>nd</sup> Edition, 1975.
5. Lomba N. Paul, *Linear Programming*, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

## UNMANNED AERIAL VEHICLES A (UAV) AND THEIR APPLICATIONS

**CE-18505**

**CREDIT: 3**

**3-0-0**

**Pre-requisite:** Nil

**Unit1: Classification and Types of UAV**

(6L)

Types and their Limitations, Applications of Various Types of UAVs: VTOL, Fixed Wing, Lighter than Air, Sizes: Micro, Hand launched / Belly landing, Medium: Catapult / Net and runway landing, Large, Paved Runway

**Unit2: Components:**

(6L)

Components Required, Handling and Maintenance of the Electronic Components, Assembly / Circuit Diagram for Electronic Components, Pre Flight Check, Post Flight Check, Transmitter Module and Receiver, Transmitter Programming

**Unit 3: Payload Options**

(6L)

Optics, Sensors: RGB camera, Infrared camera, thermal imaging camera Other, Common Equipment and Personnel: Control of Flight, Pilot / 2.4GHZ Radio, Video Goggles (FPV); Laptop and Monitor; Antenna Arrays, Setup and Support

**Unit 4: Simulator Practice**

(4L)

Basic concepts of orientation, Simulator practice, Orientating, Take-off and Landing

**Unit 5: Autonomous:**

(4L)

Ground Station Software, Commands and Keywords related to Mission Planner Software, Video Session for Way-points and Mission Planning, Parameter Configuration

**Unit 6: Applications:**

(6L)

Aerial Photography, Aerial Filming, Aerial Survey Mapping – 2D/3D, Agriculture, Adventurous Sport, Oil Pipeline Inspection, Aerial Cinematography, Volumetric Analysis of Mine and Excavation Sites, Remote Inspection

**References:**

- A.R. Jha ,Theory, Design, and Applications of Unmanned Aerial Vehicles CRC Press; 1 edition
- Kimon P. Valavanis and George J. Vachtsevanos, Handbook of Unmanned Aerial Vehicles, Springer Nature, 2014
- Andrew J. Keane , András Sóbester , James P. Scanlan ,Small Unmanned Fixed-wing Aircraft Design: A Practical Approach 1st Edition, Wiley; 1 edition
- John Baichtal , Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs 1st Edition,by , Que Publishing; 1 edition
- Ian Cinnamon, Romi Kadri, Fitz Tepper , DIY Drones for the Evil Genius: Design, Build, and Customize Your Own Drones Kindle Edition, McGraw-Hill Education TAB; 1 edition