

**Diploma Civil Engineering**  
**IV<sup>th</sup> Semester Syllabus**

| <b>Subject Code</b> | <b>Subject Name</b>                       |
|---------------------|---|
| DCE401              | Hydrology                                 |
| DCE402              | Theory of Structure                       |
| DCE403              | Transportation Engineering-I              |
| DCE 404             | Advance Surveying                         |
| DCE405              | Concrete Technology                       |
| DCE 406             | Application of Civil Engineering software |

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**DCE 401 - Hydrology**

|                     |                  |          |          |           |
|---------------------|------------------|----------|----------|-----------|
| <b>Subject Code</b> | <b>DCE 401</b>   |          |          |           |
| <b>Subject Name</b> | <b>Hydrology</b> |          |          |           |
| <b>Max. Marks</b>   | <b>100</b>       |          |          |           |
|                     | <b>L</b>         | <b>T</b> | <b>P</b> | <b>TC</b> |
|                     | <b>3</b>         | <b>1</b> | <b>-</b> | <b>4</b>  |

**COURSE OUTCOMES(COs):**

After Completing the course student should be able to:

|      |   |
|------|---|
| CO-1 | Explain the hydrological cycle, water budget, precipitation processes, and meteorological observations.                     |
| CO-2 | Measure, analyze, and interpret rainfall data using rain gauges, hyetographs, mass curves, and IDF curves.                  |
| CO-3 | Apply methods for streamflow measurement, stage-discharge relations, hydrograph analysis, and evaporation estimation.       |
| CO-4 | Analyze infiltration processes, apply Darcy's law for groundwater flow, and determine well yield and groundwater potential. |
| CO-5 | Evaluate runoff, rainfall-runoff relationships, and apply hydrograph and unit hydrograph theory for hydrologic analysis.    |

**COURSE CONTENTS:**

**UNIT-I**

Hydrological cycle, water budget, Practical applications of Hydrology, Formation of precipitation, types of precipitation, meteorological observations.

**Unit-II**

Catchment its type and importance, measurement of precipitation, Raingauges, location of raingauges, interpretations & analysis of rainfall data, calculation of average rainfall, Hyetograph, Intensity-duration, Frequency curves, Mass curve.

**UNIT-III**

Stream flow measurement and various methods, stage-discharge relations. Rating curve and its extension, stream gauge Networking, stage & discharge hydrographs, evaporation & evapotranspiration-calculation, factors affecting measurement, Reducing evaporation.

**Unit-IV**

Infiltration, Factors affecting it, measurement of Infiltration, Infiltration equation and Indices, Occurrence of ground water, Darcey's law, flow in wells (steady & unsteady), Ground water exploration. Yield of well, determination of yield.

**Unit-V**

Runoff and its components, factors affecting runoff, Basin yield, Rainfall-Runoff relationships, flow-duration curve, flow mass curve, Hydrograph, separation of hydrograph, unit hydrograph - theory & application, derivation of unit hydrograph convolution equation, unit hydrograph from complex storms unit hydrograph for various durations.

**Reference Books: -**

1. Engineering Hydrology by Subramanyam
2. Introduction to hydrology By: Viessman & Lewis
3. Applied Hydrology By: CW Fetter
4. A text Book of Hydrology By: Reddy

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**DCE 402 -Theory of Structure**

|                     |                            |          |          |           |
|---------------------|----------------------------|----------|----------|-----------|
| <b>Subject Code</b> | <b>DCE 402</b>             |          |          |           |
| <b>Subject Name</b> | <b>Theory of Structure</b> |          |          |           |
| <b>Max. Marks</b>   | <b>150</b>                 |          |          |           |
|                     | <b>L</b>                   | <b>T</b> | <b>P</b> | <b>TC</b> |
|                     | <b>3</b>                   | <b>1</b> | <b>2</b> | <b>6</b>  |

**COURSE OUTCOMES(COs):**

After Completing the course student should be able to:

|      |   |
|------|---|
| CO-1 | Analyze stresses induced in vertical member subjected to direct and bending loads.                |
| CO-2 | Analyze slope and Deflection in fixed and continuous beams.                                       |
| CO-3 | Analyze continuous beam under different loading conditions using the principles of Three Moments. |
| CO-4 | Analyze continuous beam using Moment Distribution Method under different loading conditions.      |
| CO-5 | Evaluate axial forces in the members of simple truss.   |

**COURSE CONTENTS:**

**Unit-I Direct and Bending Stresses in vertical members**

Introduction to axial and eccentric loads, eccentricity about one principal axis only, nature of stresses, Maximum and minimum stresses, resultant stresses and distribution diagram. Condition for no tension or zero stress at extreme fiber, Limit of eccentricity, core of section for rectangular and circular cross sections, Middle third rule. Chimneys of circular cross section subjected to wind pressure, Maximum and minimum stresses, resultant stresses and distribution diagram at base.

**Unit-II Slope and Deflection**

Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation). Double integration method to find slope and deflection of cantilever and simply supported beams subjected to concentrated load and uniformly distributed load on entire span.

**Unit-III Fixed and Continuous Beam**

Concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam. Principle of superposition, Fixed end moments from first principle for beam subjected to point load, UDL over entire span. Application of standard formulae in finding end moments, end reactions and drawing S.F. and B.M. diagrams for a fixed beam. Drawing SF diagrams showing point of contraflexure, shear and BM diagrams showing net BM and point of contraflexure for continuous beams.

**Unit-IV Moment distribution method**

Introduction to moment distribution method, sign convention, Carry over factor, stiffness factor, distribution factor. Application of moment distribution method to various types of continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same or different moment of inertia, supports at same level, up to three spans and two unknown support moments only.

**Unit-V Simple trusses**

Types of trusses (Simple, Fink, compound fink, French truss, pratt truss, Howe truss, North light truss, King post and Queen post truss), Calculate support reactions for trusses subjected to point loads at joints. Calculate forces in members of truss using Method of joints and Method of sections.

**Reference Books: -**

1. Ramamrutham. S, Theory of structures, Dhanpat rai & Sons.
2. Khurmi, R.S., Theory of Structures S. Chand and Co., New Delhi.
3. Bhavikatti ,SS, Structural AnalysisVol-1,,Vikas Publishing House Pvt. Ltd. New Delhi.
4. Junnarkar, S.B., Mechanics of structures, Volume-I and II Charotar Publishing House, Anand.

5. Pandit, G.S. and Gupta, S.P., Theory of Structures, Tata Mc Graw Hill, New Delhi.
6. Agor R, Structural Analysis, Khanna Publishing House, Delhi.

**LIST OF PRACTICAL TO BE PERFORMED:**

1. To study stress distribution in a short column under eccentric loading and verify the no-tension condition.
2. To determine mid-span deflection of a simply supported beam and verify the relation  $\delta = PL^3/(48EI)$ .
3. To measure reactions of a fixed beam, compute end moments, and draw SFD/BMD.
4. To analyze a continuous beam by moment distribution method and validate with experimental data.
5. To determine forces in a simple truss using the method of joints and compare with experimental results.

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**DCE403 - Transportation Engineering-I**

|                     |                                     |          |          |           |
|---------------------|-------------------------------------|----------|----------|-----------|
| <b>Subject Code</b> | <b>DCE 403</b>                      |          |          |           |
| <b>Subject Name</b> | <b>Transportation Engineering-I</b> |          |          |           |
| <b>Max. Marks</b>   | <b>150</b>                          |          |          |           |
|                     | <b>L</b>                            | <b>T</b> | <b>P</b> | <b>TC</b> |
|                     | <b>3</b>                            | <b>1</b> | <b>2</b> | <b>6</b>  |

**COURSE OUTCOMES (COs)**

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

|      |  |
|------|--|
| CO-1 | Explain the basic elements of highway geometric design such as width, camber, curves, and sight distances. |
| CO-2 | Identify and describe types of flexible pavements, surface treatments, and their construction practices.   |
| CO-3 | Apply the principles of rigid pavement design and describe their construction and maintenance.             |
| CO-4 | Analyze the importance of drainage and apply stabilization methods in low-cost road construction.          |
| CO-5 | Summarize the principles of airport planning, runway length, taxiways, and capacity considerations.        |

**COURSE CONTENTS:**

**Unit-I Geometric Design of Highways**

Cross-sectional elements: width of carriageway, camber, super-elevation. Sight distances and extra widening at curves. Horizontal and vertical curves – basic concepts and simple design problems.

**Unit-II Flexible Pavements and Bituminous Roads**

Types of pavements: WBM, WMM, BM, IBM, Bituminous roads. Design of flexible pavements, design of mixes and stability. Surface treatments: seal coat, tack coat, prime coat, surface dressing, wearing course. Introduction to design of flexible pavements (CBR method). Construction and routine maintenance of bituminous roads.

**Unit-III Cement Concrete Roads (Rigid Pavements)**

Advantages and disadvantages of cement concrete roads. General principles of design of rigid pavements (basic idea, no advanced analysis). Construction methods of cement concrete roads. Types of joints and simple maintenance practices. Study of recent developments in cements concrete pavement design,

**Unit-IV Road Drainage and Low-Cost Roads**

Drainage systems, Importance of road drainage. Surface and sub-surface drainage systems. Low-cost roads: earthen roads, gravel roads, stabilized soil roads, Stabilization methods and macadam roads. Quality control measures in construction.

**Unit-V Airport Planning and Runways**

Airport site selection. Aircraft characteristics and their effect on runway orientation. Windrose diagram and basic runway length calculations (simple corrections). Classification of airports. Basic geometric elements of runways and taxiways, runway capacity (introductory).

**Reference Books: -**

1. Chakraborty, P. and Das, A., *Principles of Transportation Engineering*, PHI Learning, New Delhi.
2. Bindra, S.P., *Principles and Practice of Bridge Engineering*, Dhanpat Rai & Sons, New Delhi.
3. Saxena, S.C., *Railways, Bridges and Tunnels*, Dhanpat Rai Publications, New Delhi.
4. Khanna, S.K. and Justo, C.E.G., *Highway Engineering*, Nem Chand & Bros., Roorkee.
5. Gurucharan Singh, *Highway Engineering*, Standard Book House, Delhi.
6. Sharma, R.C. and Sharma, K.K., *Principles and Practice of Highway Engineering*, Asian Books, New Delhi.
7. Khanna, S.K. and Arora, M.G., *Airport Planning and Design*, Nem Chand & Bros., Roorkee.
8. Relevant IRC (**Indian Roads Congress**) and IS Codes.

**LIST OF PRACTICAL TO BE PERFORMED:**

1. Determination of Aggregate Crushing Value.
2. Determination of Aggregate Impact Value.
3. Determination of Los Angeles Abrasion Value.
4. Determination of California Bearing Ratio (CBR).
5. Determination of Penetration Value of Bitumen.
6. Determination of Softening Point of Bituminous Material.
7. Determination of Ductility of Bitumen.
8. Determination of Flash Point and Fire Point of Bituminous Material.
9. Determination of Stripping Value of Road Aggregates.
10. Determination of Shape Tests on Aggregates (Flakiness and Elongation Indices)

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**DCE404 - Advance Surveying**

|                     |                          |          |          |           |
|---------------------|--------------------------|----------|----------|-----------|
| <b>Subject Code</b> | <b>DCE404</b>            |          |          |           |
| <b>Subject Name</b> | <b>Advance Surveying</b> |          |          |           |
| <b>Max. Marks</b>   | <b>150</b>               |          |          |           |
|                     | <b>L</b>                 | <b>T</b> | <b>P</b> | <b>TC</b> |
|                     | <b>3</b>                 | <b>1</b> | <b>2</b> | <b>6</b>  |

**COURSE OUTCOMES (COs)**

After Completing the course student should be able to:

|      |  |
|------|--|
| CO-1 | Set up and perform plane table surveys using radiation, intersection, and traversing methods, and explain their suitability in various field conditions. |
| CO-2 | Operate a transit theodolite to accurately measure horizontal, vertical, and deflection angles; apply methods like repetition to minimize errors.        |
| CO-3 | Conduct tacheometric surveys and calculate distances and elevations using tacheometric principles and instruments.                                       |
| CO-4 | Demonstrate the ability to use advanced surveying equipment such as digital theodolites, EDMs, and total stations for precise measurements.              |
| CO-5 | Analyze and interpret survey data obtained from conventional and modern surveying instruments, including satellite and GPS data.                         |

**COURSE CONTENTS:**

**UNIT-I Plane Table Survey**

Principles of plane table survey. Accessories required. Setting out of plane table, Leveling, Centering and orientation. Methods of plane table surveying – Radiation, Intersection, and Traversing. Merits and Demerits of plane table Surveying. Situations where plane table survey is used. Use of Telescopic Alidade.

**Unit-II Theodolite Survey**

Components of Transit Theodolite and Their functions. Technical terms used. Temporary adjustments of Transit Theodolite. Swinging the telescope, Transiting, Changing the face.

Measurement of Horizontal angle, method of Repetition, errors eliminated by method of repetition. Measurement of Deflection angle. Measurement of Vertical angle. Measurement of magnetic bearing of a line by Theodolite. Prolonging a Straight line. Sources of errors in Theodolite Surveying. Permanent adjustment of transit Theodolite (only relationship of different axes of Theodolite.) Traversing with Theodolite – Method of included angles, locating details, checks in closed traverse, Calculation of bearings from angles.

### **UNIT-III Tacheometric Survey**

Principle of Tacheometry. Essential requirements of Tacheometer. Use of Theodolite as a Tacheometer with staff held in vertical and fixed hair method (No derivation). Determination of tacheometric constants, simple numerical problems on above topics

### **Unit-IV Advanced Survey Equipment**

Construction and use of one second Micro Optic Theodolite, Electronic Digital Theodolite. Features of Electronic Theodolite Principle of E.D.M, Components of E.D.M and their functions, use of E.D.M. Total station.

### **Unit-V Aerial Survey And Remote Sensing**

Aerial Survey Introductions, definition, Aerial photograph. Remote Sensing – Introduction, Electro-Magnetic Energy, Remote sensing system Passive system, Active system. Applications – mineral, land use / Land cover, Natural Hazards and Environmental engineering system.

### **Reference Books: -**

1. Surveying and Levelling by N.N. Basak, Tata Mc Graw-Hill
2. Surveying and Levelling, Vol. I And II, Dr. B. C. Punmiya Laxmi Publication
3. Surveying And Levelling, Vol. I And II S. K. Duggal, Tata Mc Graw-Hill.
4. Surveying And Levelling, Part I And II T .P. Kanetkar & S. V.Kulkarni, Pune Vidhyarthi Griha Prakashan.

### **LIST OF PRACTICAL TO BE PERFORMED:**

1. Using accessories carry out temporary adjustments of plane table. Locating details by method of Radiation.
2. Locating details with plane table by method of intersection.
3. Understanding the components of Theodolite and their functions, reading the vernier and temporary adjustments of theodolite.

4. Measurement of Horizontal angle by transit theodolite.
5. Measurement of Horizontal angle by method of Repetition.
6. Measurement of vertical angles by theodolite.
7. Study of E.D.M. for knowing its components.
8. Use of EDM for finding horizontal and vertical distances and reduced levels.
9. Determine the geographical parameters by total station.
10. Use of Aerial survey (GPS, google earth, ISRO satellite etc.).

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**DCE405 - CONCRETE TECHNOLOGY**

|                     |                            |          |          |           |
|---------------------|----------------------------|----------|----------|-----------|
| <b>Subject Code</b> | <b>DCE 405</b>             |          |          |           |
| <b>Subject Name</b> | <b>CONCRETE TECHNOLOGY</b> |          |          |           |
| <b>Max. Marks</b>   | <b>150</b>                 |          |          |           |
|                     | <b>L</b>                   | <b>T</b> | <b>P</b> | <b>TC</b> |
|                     | <b>3</b>                   | <b>1</b> | <b>2</b> | <b>6</b>  |

**COURSE OUTCOMES (COs)**

After completing this course, students will be able to:

|      |  |
|------|--|
| CO-1 | Identify the properties of cement, water, fine and coarse aggregates.                |
| CO-2 | Classify and apply admixtures for improving concrete performance.                    |
| CO-3 | Analyze workability, strength, durability and cracking issues in concrete.           |
| CO-4 | Demonstrate proper concrete operations like batching, mixing, compaction and curing. |
| CO-5 | Evaluate causes of damage and recommend suitable repair and maintenance methods.     |

**COURSE CONTENTS:**

**Unit-I Concrete Ingredients**

Composition, Bogue's compounds, hydration, properties, tests, and effect of storage. **Water:** Quality requirements and limits on impurities (as per IS). **Fine Aggregates:** Properties, grading (IS 383), deleterious materials, M-sand, P-sand, filtered sand. **Coarse Aggregates:** Size, shape, texture, properties, flakiness, elongation, strength tests, storage, and recycled aggregates.

**Unit-II Admixtures and Fresh Concrete**

**Mineral Admixtures:** Fly ash, GGBS, silica fume – composition, properties, uses. **Chemical Admixtures:** Plasticizers, superplasticizers, accelerators, retarders, air-entraining and waterproofing agents. **Concrete Mix:** Grades, nominal/design mix, IS 456 provisions, water–cement ratio. **Fresh Concrete:** Workability, factors affecting workability, segregation, bleeding, and preventive measures.

**Unit-III Hardened Concrete and Durability**

Properties: Strength, durability, permeability. Factors: W/c ratio, gel–space ratio, maturity, aggregate properties. Strength tests: Compressive, split tensile, bond strength, modulus of rupture, core test. Shrinkage and creep: Factors, effects, measurement. Cracks in concrete: Settlement, thermal, design deficiencies. Concrete in aggressive environments: Alkali–aggregate reaction, sulphate, chloride, acid, sea water, carbonation, freezing/thawing, coatings.

**Unit-IV Concrete Operations and Special Concretes**

Operations: Batching (weight/volume), water measurement, mixing (hand/machine), transportation, compaction, finishing, curing, equipment care. Special Concretes: High strength, high performance, pervious, high density, self-compacting. Advanced Types: Fiber reinforced, lightweight, geopolymer concrete – ingredients, preparation, uses.

**Unit-V Repairs and Maintenance of Concrete Structures**

Causes of damage in concrete. Condition survey and evaluation methods. Selection of repair materials and market options. Techniques: Crack repair, corrosion control, structural repair, strengthening methods.

**Reference Books: -**

1. Concrete Technology, Shetty, M.S, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi
2. Concrete Technology, Gambhir, M.L, Tata McGraw Hill Publishing Co. Ltd., Delhi
3. Concrete Technology, Santhakumar, A. R., Oxford University Press, New Delhi
4. Laboratory Manual in Concrete Technology, Sood, H., Kulkarni P. D., Mittal L. N., CBS Publishers, New Delhi.
5. Concrete Technology, Neville, A. M , Pearson Education Pvt. Ltd., New Delhi.

**LIST OF PRACTICAL TO BE PERFORMED:**

1. To determine the properties of cement through standard tests.
2. To evaluate the properties of fine aggregate.
3. To study the properties of coarse aggregate.
4. To assess the workability of concrete using the slump test.
5. To measure the workability of nominal mix concrete using the compaction factor test.
6. To conduct market analysis of cement based on price, grades, and brands.
7. To study recycled coarse aggregate and prepare a report.

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**DCE 406 Application of Civil Engineering software**

|                     |  |          |          |           |
|---------------------|--|----------|----------|-----------|
| <b>Subject Code</b> | <b>DCE 406</b>                                   |          |          |           |
| <b>Subject Name</b> | <b>Application of Civil Engineering software</b> |          |          |           |
| <b>Max. Marks</b>   | -  |          |          |           |
|                     | <b>L</b>   | <b>T</b> | <b>P</b> | <b>TC</b> |
|                     | -  | -        | -        | -         |

**COURSE OUTCOMES (COs)**

After completing this course, students will be able to:

|      |   |
|------|---|
| CO-1 | Operate basic drafting and modeling software used in civil engineering. |
| CO-2 | Prepare simple 2D drawings using AutoCAD.                               |
| CO-3 | Use Excel for quantity, cost, and engineering calculations.             |
| CO-4 | Visualize basic 3D structures using beginner-level tools.               |
| CO-5 | Prepare simple estimation and planning sheets for office/site use       |

**COURSE CONTENTS:**

**Unit I – Introduction to Engineering Software**

- Overview of computer requirements for engineering work
- Installation basics, file types, and project folder management
- Introduction to drafting and analysis environments

**Unit II – AutoCAD (Basic Level)**

- CAD interface and drawing tools
- Creating simple 2D drawings (plan, section, elevation)
- Dimensioning, layers, printing, and PDF export

**Unit III – MS Excel for Civil Engineering Calculations**

- Quantity sheets, bar bending schedule basics
- Use of formulas, tables, and charts
- Preparing cost and material statements

**Unit IV – SketchUp / 3D Visualization (Basic)**

- Introduction to 3D modelling tools
- Simple building modeling
- Exporting views and basic rendering

**Unit V – Estimation & Project Tools**

- Introduction to MS Excel templates for estimation
- Basics of MS Project / open-source planning tools
- Preparing simple timelines, material logs, and site reports