

**STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA**

**TEACHING AND EVALUATION SCHEME FOR 4th Semester (Civil Engineering)(wef 2019-20)**

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
<b>Theory</b>									
Th.1		Structural Design - I	5		-	20	80	3	100
Th.2		Hydraulic and Irrigation Engineering	5		-	20	80	3	100
Th.3		Surveying – I	5		-	20	80	3	100
Th.4		Highway Engineering	5			20	80	3	100
		<i>Total</i>	<i>20</i>			<i>80</i>	<i>320</i>	<i>-</i>	<i>400</i>
<b>Practical</b>									
Pr.1		Survey Practice-I	-	-	7	50	100	3	150
Pr.2		Civil Engg. Drawing-II	-	-	6	50	100	3	150
Pr.3		Technical Seminar			3	50			50
		Student Centered Activities(SCA)		-	3				
		<i>Total</i>	<i>-</i>	<i>-</i>	<i>19</i>	<i>150</i>	<i>200</i>	<i>-</i>	<i>350</i>
		<b>Grand Total</b>	<b>20</b>	<b>-</b>	<b>19</b>	<b>230</b>	<b>520</b>	<b>-</b>	<b>750</b>

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

**Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%**

**SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.**

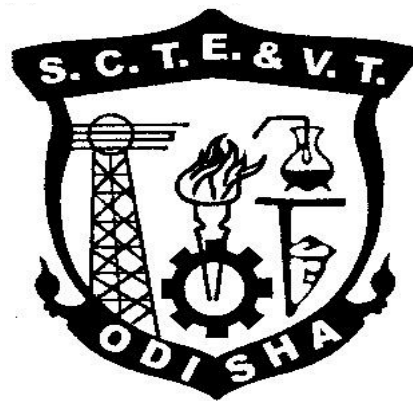
**There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester**

# **CURRICULLUM OF 4<sup>TH</sup> SEMESTER**

**For**

**DIPLOMA IN CIVIL ENGINEERING**

**(Effective FROM 2019-20 Session)**



**STATE COUNCIL FOR TECHNICAL  
EDUCATION & VOCATIONAL TRAINING,  
ODISHA, BHUBANESWAR**

# Th1. STRUCTURAL DESIGN – I

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	4 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

(Use of only IS 456 code is allowed in the written examination)

## A. RATIONALE

The course will enable the students to undertake activities relating to the Design of simple Civil structural elements in view of load conditions and regulations imposed by standard or codes.

## B. COURSE OBJECTIVES

On completion of the subject a student will be able to –

1. Comprehend design philosophies and compare those
2. Refer the design codes
3. Design simple R.C. structural elements
4. Draw structural details for construction
5. Analyze and design structural elements such as beams, columns, staircase etc
6. Design formwork and scaffolding.

## C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Periods
1	Working stress method (WSM)	05
2	Philosophy of Limit state method (LSM)	03
3	Analysis and design of singly and double reinforced sections (LSM)	15
4	Shear, Bond and Development Length (LSM)	04
6	Analysis and Design of T-Beam (LSM)	15
7	Analysis and Design of Slab and Stair case (LSM)	15
8	Design of Axially loaded columns and Footings (LSM)	18

## D. COURSE CONTENTS:

(The codal provision for I.S.456 – 2000 along with other codes are to be followed)

### 1 Working stress method (WSM)

- 1.1 Objectives of design and detailing. State the different methods of design of concrete structures.
- 1.2 Introduction to reinforced concrete, R.C. sections their behavior, grades of concrete and steel. Permissible stresses, assumption in W.S.M.
- 1.3 Flexural design and analysis of single reinforced sections from first principles.
- 1.4 Concept of under reinforced, over reinforced and balanced sections.

1.5 Advantages and disadvantages of WSM, reasons for its obsolescence.

## **2 Philosophy Of Limit State Method (LSM)**

2.1 Definition, Advantages of LSM over WSM, IS code suggestions regarding design philosophy.

2.2 Types of limit states, partial safety factors for materials strength, characteristic strength, characteristic load, design load, loading on structure as per I.S. 875

2.3 Study of I.S specification regarding spacing of reinforcement in slab, cover to reinforcement in slab, beam column & footing, minimum reinforcement in slab, beam & column, lapping, anchorage, effective span for beam & slab.

## **3 Analysis and Design of Single and Double Reinforced Sections (LSM)**

3.1 Limit state of collapse (flexure), Assumptions, Stress-Strain relationship for concrete and steel, neutral axis, stress block diagram and strain diagram for singly reinforced section.

3.2 Concept of under- reinforced, over-reinforced and limiting section, neutral axis co-efficient, limiting value of moment of resistance and limiting percentage of steel required for limiting singly R.C. section.

3.3 Analysis and design: determination of design constants, moment of resistance and area of steel for rectangular sections

3.4 Necessity of doubly reinforced section, design of doubly reinforced rectangular section

## **4 Shear, Bond and Development Length (LSM)**

4.1 Nominal shear stress in R.C. section, design shear strength of concrete, maximum shear stress, design of shear reinforcement, minimum shear reinforcement, forms of shear reinforcement.

4.2 Bond and types of bond, bond stress, check for bond stress, development length in tension and compression, anchorage value for hooks 90° bend and 45° bend standards lapping of bars, check for development length.

4.3 Numerical problems on deciding whether shear reinforcement is required or not, check for adequacy of the section in shear. Design of shear reinforcement; Minimum shear reinforcement in beams (Explain through examples only).

## **5 Analysis and Design of T-Beam (LSM)**

- 5.1 General features, advantages, effective width of flange as per IS: 456-2000 code provisions.
- 5.2 Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.
- 5.3 Simple numerical problems on deciding effective flange width. (Problems only on finding moment of resistance of T-beam section when N.A. lies within or up to the bottom of flange shall be asked in written examination)..

## **6 Analysis and Design of Slab and Stair case (LSM)**

- 6.1 Design of simply supported one-way slabs for flexure check for deflection control and shear.
- 6.2 Design of one-way cantilever slabs and cantilevers chajjas for flexure check for deflection control and check for development length and shear.
- 6.3 Design of two-way simply supported slabs for flexure with corner free to lift.
- 6.4 Design of dog-legged staircase
- 6.5 Detailing of reinforcement in stairs spanning longitudinally.

## **7 Design of Axially loaded columns and Footings (LSM)**

- 7.1 Assumptions in limit state of collapse- compression.
- 7.2 Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
- 7.3 Analysis and design of axially loaded short square, rectangular and circular columns (with lateral ties only).
- 7.4 Types of footing, Design of isolated square column footing of uniform thickness for flexure and shear.

**E. Syllabus Coverage up to Internal Assessment:** Chapters 1, 2, 3, 4

## F. RECOMMENDED BOOKS

<b>Sl. No</b>	<b>Name of Authors</b>	<b>Titles of Book</b>	<b>Name of Publisher</b>
1	N.Subramanian	Design of Reinforced Concrete Structures	Oxford Pbln
2	N.C.Sinha,S.K.Roy	Fundamentals of Reinforced Concrete	S.Chand
3	H.J Saha.	Reinforced Concrete	Charotar Publishing house
4	Pillai & Menon.	Reinforced Concrete Structures	Tata McGraw Hill Education Private Limited
5	A.K. Jain.	Limit State Method (RCC Design )	Nem Chand & Bros
6	IS:456-2000		BIS Publication
7	SP-16		BIS Publication

## Th2. HYDRAULICS & IRRIGATION ENGINEERING

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	4 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

### A. RATIONALE

The course will be imparted in two parts. Primarily it aims to explain students the need of irrigation and components of the irrigation system which is covered in the second part of the course. The course aims to explain students the intricacies of irrigation engineering with reference to basic sciences relating to fluid mechanics and hydraulic machines. The essential components of fluid mechanics and hydraulic machines will be addressed in the first part of the course.

### B. COURSE OBJECTIVES

On completion of the course students will be able to -

1. Define common fluid properties and interpret results from pressure measuring instruments.
2. Realize the science behind fluid flow and compute fluid flow characteristics through notches, weirs, channels and pipes.
3. Realize the working principle of hydraulic pumps and evaluate their performance in general cases.
4. Comprehend the need of irrigation
5. Determine cause and effect of water logging
6. Comprehend the purpose of irrigation system components and elaborate on these

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name Of Topics	Periods
<i>PART: A (Hydraulics And Machines)</i>		
1	Hydrostatics	12
2	Kinematics Of Fluid Flow	18
3	Pumps	05
<i>Part: B (Irrigation Engineering)</i>		
1	Hydrology	04
2	Water Requirement Of Crops	04
3	Flow Irrigation	07
4	Water Logging And Drainage :	02
5	Diversion Head Works And Regulatory Structures	08
6	Cross Drainage Works :	07
7	Dams	08

## D. COURSE CONTENTS:

### ***PART: A (Hydraulics)***

#### **1 HYDROSTATICS:**

1.1 **Properties of fluid:** density, specific gravity, surface tension, capillarity, viscosity and their uses

1.2 **Pressure and its measurements:** intensity of pressure, atmospheric pressure, gauge pressure, absolute pressure and vacuum pressure; relationship between atmospheric pressure, absolute pressure and gauge pressure; pressure head; pressure gauges.

1.3 **Pressure exerted on an immersed surface:** Total pressure, resultant pressure, expression for total pressure exerted on horizontal & vertical surface.

#### **2 KINEMATICS OF FLUID FLOW:**

2.1 **Basic equation of fluid flow and their application:** Rate of discharge, equation of continuity of liquid flow, total energy of a liquid in motion- potential, kinetic & pressure, Bernoulli's theorem and its limitations. Practical applications of Bernoulli's equation.

2.2 **Flow over Notches and Weirs:** Notches, Weirs, types of notches and weirs, Discharge through different types of notches and weirs-their application (No Derivation)

2.3 **Types of flow through the pipes:** uniform and non uniform; laminar and turbulent; steady and unsteady; Reynold's number and its application

2.4 **Losses of head of a liquid flowing through pipes:** Different types of major and minor losses. Simple numerical problems on losses due to friction using Darcy's equation, Total energy lines & hydraulic gradient lines (Concept Only).

2.5 **Flow through the Open Channels:** Types of channel sections-rectangular, trapezoidal and circular, discharge formulae- Chezy's and Manning's equation, Best economical section.

#### **3 PUMPS:**

3.1 **Type of pumps**

3.2 **Centrifugal pump:** basic principles, operation, discharge, horse power & efficiency.

3.3 **Reciprocating pumps:** types, operation, discharge, horse power & efficiency

### ***PART: B (Irrigation Engineering)***

#### **1 Hydrology**

1.1 Hydrology Cycle

1.2 Rainfall: types, intensity, hyetograph

1.3 Estimation of rainfall, rain gauges, Its types(concept only),

1.4 Concept of catchment area, types, run-off, estimation of flood discharge by Dicken's and Ryve's formulae

#### **2 Water Requirement of Crops**

2.1 Definition of irrigation, necessity, benefits of irrigation, types of irrigation

2.2 Crop season

2.3 Duty, Delta and base period their relationship, overlap allowance, kharif and rabi crops

2.4 Gross command area, culturable command area, Intensity of Irrigation, irrigable area, time factor, crop ratio



- 3 FLOW IRRIGATION**  
 3.1 Canal irrigation, types of canals, loss of water in canals  
 3.2 Perennial irrigation  
 3.3 Different components of irrigation canals and their functions  
 3.4 Sketches of different canal cross-sections  
 3.5 Classification of canals according to their alignment, Various types of canal lining – Advantages and disadvantages
- 4 WATER LOGGING AND DRAINAGE :**  
 4.1 Causes and effects of water logging, detection, prevention and remedies
- 5 DIVERSION HEAD WORKS AND REGULATORY STRUCTURES**  
 5.1 Necessity and objectives of diversion head works, weirs and barrages  
 5.2 General layout, functions of different parts of barrage  
 5.3 Silting and scouring  
 5.4 Functions of regulatory structures
- 6 CROSS DRAINAGE WORKS :**  
 6.1 Functions and necessity of Cross drainage works - aqueduct, siphon, super-passage, level crossing  
 6.2 Concept of each with help of neat sketch
- 7 DAMS**  
 7.1 Necessity of storage reservoirs, types of dams  
 7.2 Earthen dams: types, description, causes of failure and protection measures.  
 7.3 Gravity dam- types, description, Causes of failure and protection measures.  
 7.4 Spillways- Types (With Sketch) and necessity.

**E. Syllabus Coverage up to Internal Assessment: Part A:** Chapters 1, 2 & Part B: 1, 2

**F. RECOMMENDED BOOKS**

Sl. No	Name of Authors	Titles of Book	Name of Publisher
1	Modi & Seth	Fluid Mechanics & Hydraulic machines	Standard Book House
2	D.R. Biswal	Hydraulics & Fluid Mechanics	Kalyani Pbln
3	R.K.Rajput	A Text Book of Fluid Mechanics & Hydraulic machines	S.Chand

Sl. No	Name of Authors	Titles of Book	Name of Publisher
1	S.K.Garg	Irrigation Engineering & Hydraulics Structures	Khanna Publishers
2	N. N. Basak	Irrigation Engineering	TMH Publishing
3	S.K. Sharma	Irrigation Engineering & Hydraulic structures.	S. Chand Pbln

## Th3. SURVEY – I

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	4 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

### A. RATIONALE

Survey is an essential prerequisite for all types of civil construction activities. This course aims to provide knowledge in area of plane survey and the survey instruments. Besides, the course aims to provide students in map reading and area computations from survey data.

### B. COURSE OBJECTIVES

On completion of the course students will be able to

1. Define various survey terminology and carryout necessary corrections for errors
2. Comprehend the principle, purpose, equipment and error corrections in chain and compass surveying
3. Comprehend the principle, purpose, equipment and error corrections in plane table and theodolite surveying
4. Comprehend the map nomenclature and apply skills in map interpretation
5. Gather skill towards leveling and contouring with knowledge of purpose and different methods thereof
6. Compute area and volume using different numerical algebraic methods

### C. Topic Wise Distribution of Periods

Chapter	Name of topics	Periods
1	Introduction To Surveying, Linear Measurements	07
2	Chaining and Chain Surveying	07
3	Angular Measurement and Compas Surveying	12
4	Map Reading Cadastral Maps & Nomenclature	07
5	Plane Table Surveying	07
6	Theodolite Surveying and Traversing:	15
7	Levelling and Contouring	15
8	Computation of Area & Volume	05

### D. Course Contents

- 1 **INTRODUCTION TO SURVEYING, LINEAR MEASUREMENTS:**
  - 1.1 Surveying: Definition, Aims and objectives
  - 1.2 Principles of survey-Plane surveying- Geodetic Surveying- Instrumental surveying.
  - 1.3 Precision and accuracy of measurements, instruments used for measurement of distance, Types of tapes and chains.
  - 1.4 Errors and mistakes in linear measurement – classification, Sources of errors and remedies.
  - 1.5 Corrections to measured lengths due to-incorrect length, temperature variation, pull, sag, numerical problem applying corrections.

2

**CHAINING AND CHAIN SURVEYING :**

- 2.1 Equipment and accessories for chaining
- 2.2 Ranging – Purpose, signaling, direct and indirect ranging, Line ranger – features and use, error due to incorrect ranging.
- 2.3 Methods of chaining –Chaining on flat ground, Chaining on sloping ground – stepping method, Clinometer-features and use, slope correction.
- 2.4 Setting perpendicular with chain & tape, Chaining across different types of obstacles –Numerical problems on chaining across obstacles.
- 2.5 Purpose of chain surveying, Its Principles, concept of field book. Selection of survey stations, base line, tie lines, Check lines.
- 2.7 Offsets – Necessity, Perpendicular and Oblique offsets, Instruments for setting offset – Cross Staff, Optical Square.
- 2.8 Errors in chain surveying – compensating and accumulative errors causes & remedies, Precautions to be taken during chain surveying.

3

**ANGULAR MEASUREMENT AND COMPAS SURVEYING :**

- 3.1 Measurement of angles with chain, tape & compass
- 3.2 Compass – Types, features, parts, merits & demerits, testing & adjustment of compass
- 3.3 Designation of angles- concept of meridians – Magnetic, True, arbitrary; Concept of bearings – Whole circle bearing, Quadrantal bearing, Reduced bearing, suitability of application, numerical problems on conversion of bearings
- 3.4 Use of compasses – setting in field-centering, leveling, taking readings, concepts of Fore bearing, Back Bearing, Numerical problems on computation of interior & exterior angles from bearings.
- 3.5 Effects of earth's magnetism – dip of needle, magnetic declination, variation in declination, numerical problems on application of correction for declination.
- 3.6 Errors in angle measurement with compass – sources & remedies.
- 3.7 Principles of traversing – open & closed traverse, Methods of traversing.
- 3.8 Local attraction – causes, detection, errors, corrections, Numerical problems of application of correction due to local attraction.
- 3.9 Errors in compass surveying – sources & remedies. Plotting of traverse – check of closing error in closed & open traverse, Bowditch's correction, Gales table

4

**MAP READING CADASTRAL MAPS & NOMENCLATURE:**

- 4.1 Study of direction, Scale, Grid Reference and Grid Square Study of Signs and Symbols
- 4.2 Cadastral Map Preparation Methodology
- 4.3 Unique identification number of parcel
- 4.4 Positions of existing Control Points and its types
- 4.5 Adjacent Boundaries and Features, Topology Creation and verification.

5

**PLANE TABLE SURVEYING :**

- 5.1 Objectives, principles and use of plane table surveying.
- 5.2 Instruments & accessories used in plane table surveying.
- 5.3 Methods of plane table surveying – (1) Radiation, (2) Intersection, (3) Traversing, (4) Resection.
- 5.4 Statements of TWO POINT and THREE POINT PROBLEM. Errors in plane table surveying and their corrections, precautions in plane table surveying.

6

## **THEODOLITE SURVEYING AND TRAVERSING:**

6.1 Purpose and definition of theodolite surveying

6.2 Transit theodolite- Description of features, component parts, Fundamental axes of a theodolite, concept of vernier, reading a vernier, Temporary adjustment of theodolite

6.3 Concept of transiting –Measurement of horizontal and vertical angles.

6.4 Measurement of magnetic bearings, deflection angle, direct angle, setting out angles, prolonging a straight line with theodolite, Errors in Theodolite observations.

6.5 Methods of theodolite traversing with – inclined angle method, deflection angle method, bearing method, Plotting the traverse by coordinate method, Checks for open and closed traverse.

6.6 Traverse computation – consecutive coordinates, latitude and departure, Gale's traverse table, Numerical problems on omitted measurement of lengths & bearings

6.7 Closing error – adjustment of angular errors, adjustment of bearings, numerical problems

6.8 Balancing of traverse – Bowditch's method, transit method, graphical method, axis method, calculation of area of closed traverse.

7

## **LEVELLING AND CONTOURING :**

7.1 Definition and Purpose and types of leveling– concepts of level surface, Horizontal surface, vertical surface, datum, R. L., B.M.

7.2 Instruments used for leveling, concepts of line of collimation, axis of bubble tube, axis of telescope, Vertical axis.

7.3 Levelling staff – Temporary adjustments of level, taking reading with level, concept of bench mark, BS, IS, FS, CP, HI.

7.4 Field data entry – level Book – height of collimation method and Rise & Fall method, comparison, Numerical problems on reduction of levels applying both methods, Arithmetic checks.

7.5 Effects of curvature and refraction, numerical problems on application of correction.

7.6 Reciprocal leveling – principles, methods, numerical problems, precise leveling.

7.7 Errors in leveling and precautions, Permanent and temporary adjustments of different types of levels.

7.8 Definitions, concepts and characteristics of contours.

7.9 Methods of contouring, plotting contour maps, Interpretation of contour maps, toposheets.

7.10 Use of contour maps on civil engineering projects – drawing cross-sections from contour maps, locating proposal routes of roads / railway / canal on a contour map, computation of volume of earthwork from contour map for simple structure.

7.11 Map Interpretation: Interpret Human and Economic Activities (i.e.: Settlement, Communication, Land use etc.), Interpret Physical landform (i.e.: Relief, Drainage Pattern etc.), Problem Solving and Decision Making

8

## **COMPUTATION OF AREA & VOLUME:**

8.1 Determination of areas, computation of areas from plans.

8.2 Calculation of area by using ordinate rule, trapezoidal rule, Simpson's rule.

8.3 Calculation of volumes by prismatic formula and trapezoidal formula,  
Prismatic corrections, curvature correction for volumes.

**E. SYLLABUS COVERAGE UPTO INTERNAL ASSESSMENT**

Chapters 1, 2, 3, 4, 5

**G. RECOMMENDED BOOKS**

<b>Sl. No</b>	<b>Name of Authors</b>	<b>Titles of Book</b>	<b>Name of Publisher</b>
1	R.Subramanian	Surveying and Levelling	Oxford
2	Dr.B.C.Punmia.	Surveying, Vol.-I&II	Laxmi Publication
3	R. Agor	A text Book of Surveying & Levelling	Khanna Publishers
4	N.N Basak.	Surveying & Levelling	TMH Publishing

## Th4. HIGHWAY ENGINEERING

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	4 <sup>th</sup>
Total Period:	75	Examination	3 hrs
Theory periods:	5P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

### A. RATIONALE

One of the major tasks carried out by civil engineering professionals is highway construction. Knowledge is essential on necessary geometric, materials, equipment essential for highway construction. The course aims to impart knowledge in this segment.

### B. COURSE OBJECTIVES

On completion of the course students will be able to -

1. Realize significance of the highway transportation and professional bodies associated with this,
2. Acquaint themselves with road geometric terms and understand the purpose of providing necessary features including angles and curvature during road construction.
3. Select proper road construction materials based on required properties and test data.
4. Comprehend the pavements and their types and know the step wise construction processes.
5. Acquire knowledge on common construction equipment
6. Realize essence of drainage and maintenance on the highways and prescribe related practices.

### C. TOPIC WISE DISTRIBUTION

Chapter	Name of topics	Periods
1	Introduction	05
2	Road Geometrics	20
3	Road Materials	09
4	Road Pavements	13
5	Hill Roads	07
6	Road Drainage	07
7	Road Maintenance :	07
8	Construction equipments:	07

### D. COURSE CONTENTS:

- 1 Introduction**
  - 1.1 Importance of Highway transportation: importance organizations like Indian roads congress, Ministry of Surface Transport, Central Road Research Institute.
  - 1.2 Functions of Indian Roads Congress
  - 1.3 IRC classification of roads
  - 1.4 Organisation of state highway department
- 2 Road Geometrics**

- 2.1 Glossary of terms used in geometric and their importance, right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation level, camber and gradient
- 2.2 Design and average running speed, stopping and passing sight distance
- 2.3 Necessity of curves, horizontal and vertical curves including transition curves and super elevation, Methods of providing super – elevation

3

### **Road Materials**

- 3.1 Different types of road materials in use: soil, aggregates, and binders
- 3.2 Function of soil as highway Subgrade
- 3.3 California Bearing Ratio: methods of finding CBR valued in the laboratory and at site and their significance
- 3.4 Testing aggregates: Abrasion test, impact test, crushing strength test, water absorption test & soundness test

4

### **Road Pavements**

- 4.1 Road Pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components

Flexible pavements:

- 4.2 Sub-grade preparation:

Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profile of embankment, construction of embankment, compaction, stabilization, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation

- 4.3 Sub base Course:

Necessity of sub base, stabilized sub base, purpose of stabilization (no designs)

Types of stabilization

- Mechanical stabilization
- Lime stabilization
- Cement stabilization
- Fly ash stabilization

- 4.4 Base Course:

Preparation of base course, Brick soling, stone soling and metalling, Water Bound Macadam and wet-mix Macadam, Bituminous constructions: Different types

- 4.5 Surfacing:

- Surface dressing
  - (i) Premix carpet and (ii) Semi dense carpet
- Bituminous concrete
- Grouting

- 4.6 Rigid Pavements:

Concept of concrete roads as per IRC specifications

5

### **Hill Roads:**

- 5.1 Introduction: Typical cross-sections showing all details of a typical hill road in cut, partly in cutting and partly in filling

- 5.2 Breast Walls, Retaining walls, different types of bends

6

### **Road Drainage:**

- 6.1 Necessity of road drainage work, cross drainage works

6.2 Surface and sub-surface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage, intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross sections.

7

### **Road Maintenance :**

- 7.1 Common types of road failures – their causes and remedies
- 7.2 Maintenance of bituminous road such as patch work and resurfacing
- 7.3 Maintenance of concrete roads – filling cracks, repairing joints, maintenance of shoulders (berm), maintenance of traffic control devices
- 7.4 Basic concept of traffic study, Traffic safety and traffic control signal

**8 Construction equipments:**

Preliminary ideas of the following plant and equipment:

- 8.1 Hot mixing plant
- 8.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, graders, roller dragline
- 8.3 Asphalt mixer and tar boilers
- 8.4 Road pavers
- 8.5 Modern construction equipments for roads.

**E. SYLLABUS COVERAGE UPTO INTERNAL ASSESSMENT:** Chapters 1, 2, 3, 4

**F. RECOMMENDED BOOKS**

Sl. No	Name of Authors	Titles of Book	Name of Publisher
1	S.K.Khanna & C.E.G. Justo	Highway Engineering	Nem Chand & Bros
2	S.P.Chandola	A Text Book Of Transportation Engineering	S. Chand
3	S.P.Bindra	A course on Highway engineering	Dhanpat Rai Publications
4	S.K. Sharma	Principles, practices & design of Highway Engineering.	S. Chand



## Pr1. SURVEY PRACTICE-I

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	4 <sup>th</sup>
Total Period:	105	Examination	3hrs
Lab. periods:	7P/week	Term Work/Sessional	50
Maximum marks:	150	End Semester Examination:	100

### A. RATIONALE

The course prepares the students in use of survey instruments to conduct survey, present and interpret the generated data. This course, further, aims to enable students in map reading and computation of area from survey generated data. In addition, It introduces modern practice of survey that is photogrammetry which is applied in topographic mapping and site planning activities, along with the foundation for GIS information generation.

### B. COURSE OBJECTIVES

On completion of the course students will be able to

1. Undertake linear measurement activities using chains in absence or presence of obstacles
2. Conduct compass surveying and record data in necessary format
3. Read, interpret and verify a map
4. Setup plane table and conduct survey using different methods
5. Use of theodolite and plot the traverse and contour maps
6. Realize significance of photogrammetry as pictorial, accurate and permanent record and understand the basics of aerial photography
7. Acquire image through aerial and satellite platform and scanning thereof along with stereoscopic measurement
8. Generate DTM/DEM and ortho-image

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
1	Linear Measurements, Chaining and Chain Surveying	05
2	Angular Measurement and Compass Surveying	12
3	Map Reading Cadastral Maps & Nomenclature	08
4	Plane Table Surveying	13
5	Theodolite Traversing	10
6	Levelling and Contouring	12
7	Basics of Aerial Photography	09
8	Basics of Photogrammetry, DEM and Ortho Image Generation	36

## **D. COURSE CONTENTS:**

### **1.0 Linear Measurements, Chaining and Chain Surveying:**

- 1.1 Testing and adjusting of a metric chain.
- 1.2 Measurement of distance between two points (more than 2 chain lengths apart) with chain including direct ranging.
- 1.3 Setting out different types of triangles, given the lengths of sides with chain and tape.
- 1.4 Measurement of distance between two points by chaining across a sloped ground using stepping method and a clinometer.
- 1.5 Measurement of distance by chaining across a obstacles on the chain line i) a pond ii) a building iii) a stream/ river (in the event of non-availability of stream / river, a pond or lake may be taken, considering that chaining around the same is not possible.
- 1.6 Setting perpendicular offsets to various objects (at least 3) from a chain line using-(1) tape, (2) cross-staff, (3) optical square and comparing the accuracy of the 3 methods
- 1.7 Setting oblique offsets to objects (at least 3) from a chain using tape

### **2.0 Angular Measurement and Compass Surveying:**

- 2.1 Testing and adjustment of Prismatic compass and Surveyor's compass.
- 2.2 Measurement of bearings of lines (at least 3 lines) and determination of included angles using Prismatic compass and Surveyor's compass.
- 2.3 Setting out triangles (at least 2) with compass, given the length and bearing of one side and included angles.
- 2.4 Setting out a closed traverse of 5 sides, using prismatic compass, given bearing of one line and included angles and lengths of sides.
- 2.5 Conducting chain and compass traverse surveying in a given plot of area (2plots) and recording data in the field book. (5 to 6 students/groups)

### **3.0 Map Reading Cadastral Maps & Nomenclature:**

- 3.1 Study of direction, Scale, Grid Reference and Grid Square
- 3.2 Study of Signs and Symbols
- 3.3 Cadastral Map Preparation Methodology
- 3.4 Unique identification number of parcel
- 3.5 Positions of existing Control Points and its types
- 3.6 Adjacent Boundaries and Features, Topology Creation and verification.

### **4.0 Plane Table Surveying:**

- 4.1 Setting up of Plane Table and Plotting five points by radiation method and five inaccessible points by intersection method.
- 4.2 Conducting Plane Table surveying in a given plot of area by traversing (Atleast a 5-sided traverse and locating the objects)
- 4.3 Plane table surveying by Resection method (two point & three point problem method)

### **5.0 Theodolite Traversing:**

- 5.1 Measurement of horizontal angles (3nos.) by repetition and reiteration method and compare two methods
- 5.2 Prolonging a given straight line with the help of a theodolite
- 5.3 Determination of magnetic bearing of 3 given straight lines

- Setting out a closed traverse with 6 sides and entering the field data
- 5.4 Plotting the traverse from exercise 4.1 and checking the error of closure
- 5.5 Setting out an open traverse with 5 sides and entering the field data
- 5.6 Plotting the traverse from exercise 4.3 and checking the error of closure

## **6.0 Leveling and Contouring:**

- 6.1 Making temporary adjustments of Levels
- 6.2 Determining Reduced Levels of five given points taking staff readings with Levels.
- 6.3 Determining the difference of levels between two points (3 pairs of points / group) by taking staff readings from single set up of level, recording the readings in level book and application of Arithmetic check. (At least 3 change points must be covered)
- 6.4 Conduct Fly Leveling (Compound) between two distant points with respect to R.L. of a given B.M. and reduction of levels by both height of collimation and rise & fall method and applying Arithmetic check. (At least 3 change points must be covered)
- 6.5 Conduct profile leveling along the given alignment for a road / canal for 150m length, taking L. S. at every 15m and C. S. at 1m & 3m apart on both sides at every 30m interval and recording the data in level book and applying arithmetical check.
- 6.6 Locating contour points in the given area by direct method / indirect method
- 6.7 Conducting block level survey in the given area
- 6.8 Plotting and drawing contour map of a given area by radial method
- 6.9 Map Interpretation: Interpret Human and Economic Activities (i.e.: Settlement, Communication, Land use etc.), Interpret Physical landform (i.e.: Relief, Drainage Pattern etc.), Problem Solving and Decision Making

## **7.0 Basics of Aerial Photography:**

- 7.1 Film
- 7.2. Focal Length
- 7.3. Scale
- 7.4. Types of Aerial Photographs (Oblique, Straight)

## **8.0 Basics of Photogrammetry, DEM and Ortho Image generation:**

Photogrammetry:

- 8.1 Classification of Photogrammetry
- 8.2 Aerial Photogrammetry
- 8.3 Terrestrial Photogrammetry

Photogrammetry Process:

- 8.4 Acquisition of Imagery using aerial and satellite platform
- 8.5 Control Survey
- 8.6 Geometric Distortion in Imagery
- 8.7 Application of Imagery and its support data
- 8.8 Orientation and Triangulation
- 8.9 Stereoscopic Measurement: X-parallax and Y-parallax
- 8.10 DTM/DEM Generation
- 8.11 Ortho Image Generation

## **E. RECOMMENDED BOOKS:**

- |                                       |                        |
|---------------------------------------|------------------------|
| ○ Surveying and Leveling              | - R.Subramanian        |
| ○ Surveying, Vol.-I&II                | -Dr.B.C.Punmia         |
| ○ A text Book of Surveying & Leveling | -R.Agor.               |
| ○ Surveying Part-III                  | - Dr.B.C.Punmia        |
| ○ Advanced Surveying                  | - D. Gaikwad, S. Chand |

## Pr2. CIVIL ENGINEERING DRAWING – II

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	4 <sup>th</sup>
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P/week	Term Work/Sessional	50
Maximum marks:	150	End Semester Examination:	100

### A. RATIONALE

The course aims to prepare the students to use modern engineering tools to prepare drawings of essential structures that include culverts, irrigation structures, sanitation components.

### B. COURSE OBJECTIVES

After completion of the course, students will be able to use AutoCAD or CAD softwares to

- Prepare RCC slab culvert drawings
- Prepare Hume pipe culvert drawings
- Prepare detailed drawings including plan, elevation and section views of irrigation structures
- Prepare detailed drawings of drainage siphons
- Generate drawings of plumbing and sanitary connections in two room buildings
- Generate detailed drawing of septic tanks

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
1	Detailed drawing of culvert	25
2	Irrigation Structures	35
3	Plumbing and Sanitary connections	10
4	septic tank up to 50 users with soak pit	20

### D. COURSE CONTENT:

**(ALL THE DRAWINGS TO BE DONE USING AUTO CAD SOFTWARE ONLY)**

#### 1.0 Detailed drawing of culvert

Half foundation plan and half top plan, cross sectional elevation and longitudinal section of

- i) RCC Slab culvert with right angled wing wall
- ii) Hume pipe culvert with splayed wing wall

#### 2.0 Irrigation Structures

- 2.1 Detail drawing of a vertical drop type fall (Sarada Type) from given specifications
- 2.2 Drawing of a Drainage siphon from given specifications

#### 3 Plumbing and Sanitary connections and fittings of a two roomed building

#### 4 Detailed drawing of septic tank up to 50 users with soak pit and necessary connection from the water closet.

#### **E. RECOMMENDED BOOKS:**

1. Civil Engg. Drawing -M.Chakrobarty.
2. Civil Engineering Drawing & House Planning -B.P.Verma.
3. A Course in Civil Engg Drawing -VB Sikka
3. Engineering graphics and design - K. Kumar, A.K. Ray & C. Ranjan- Vikas Pbln.
4. Auto Cad -Omura
5. AutoCAD (Architecture) 2011 -William G. Wyatt

### **Pr.3 -TECHNICAL SEMINAR**

Total Periods	03	Maximum Marks	50 Marks
Lab. Periods:	03 Periods /week	Term Work/Sessional	50Marks
Examination	3hours	End Semester Examination	--

Each student has to select a recent topic of latest technology in the area of Civil Engineering and present a seminar in front of all students of the class. He/She has to prepare a PowerPoint presentation of the selected topic and the total presentation will be approximately 10 minutes duration .There will be interactive session between the presenter and rest of the students including the faculty members of the dept at the end of presentation .A student has to present at least 2 nos.of seminar during a semester and to submit the report for evaluation.

## CIVIL ENGG. CAD LABORATORY

(Can be used for Engg. Drawing/Civil Engg. Drawing-I & II /Estimation & Cost  
Evaluation Practice – I & II)

**Gr. Size -30students**

<b>Sl. No.</b>	<b>Item with Specification-</b>	<b>QNTY in No.</b>
1	STAAD-Pro -V8i(Latest Educational Version – 15 user) software	1
2	AutoCAD-2016 or latest Educational version for minimum 15 users	1
3	Desk Top Computer with following latest version configuration : Processor: Intel Core i7 or higher version, CPU@2.3GHz or higher, Ram: 4GB or higher,MS Windows 64 bit operating system with 64 based processor etc.	30
4	Laptop Computer with following latest version configuration : Processor: Intel Core i7 or higher version, CPU@2.3GHz or higher, Ram: 4GB or higher,MS Windows 64 bit operating system with 64 based processor etc.	1
5	Online UPS: 5KVA	5
6	Laser Printer- Resolution in dpi: Mono 600x600, Paper size:A4, Print speed in ppm(A4 size):14, port:1 or higher configuration	1
7	Document Scanner A4/Legal size, Resolution: 600x600, Flat Bed size:A4	1
8	Plotter(44") with accessories in complete set	1
9	LCD projector 4000 ansi lumen with screen	1

**SURVEY PRACTICE I (For Gr., Size-30 students)**

Sl No.	Name of Equipments	Quantity required
1	Metallic Tape(15m,30m) in leather/fiber case and winding device as per BIS1492:1970	10
2	Steel Tape(3m,5m,15m & 30m) made of steel ribbon in leather/fiber case and winding device as per BIS1492:1970	02
3	Invar Tape(15m,30m) made of invar steel in leather/ fiber case and winding device as per BIS1492:1970	01
4	Cross Staff(Open type metallic)100X100X150 mm iron leg painted at bottom,1.5m length	10
5	Arrows(MS)	30
6	Ranging Rods(Iron) 2 & 3m length made of conduits of 30mm dia painted with white and black/red with iron shoes as per BIS2283:1983	30
7	Hammer	10
8	Prismatic Compass(150mm dia.) made of brass or gun metal Circles: Aluminum graduated every 30 minutes, Reading Agate stone bearing with help of prism glasses & reflecting mirror packed in fiber case with sighting vane and rigid stand and ball socket arrangement	06
9	Plane Table Surveying Plane Table consisting of Drawing Board 75cmX60cmX2cm made of seasoned pine wood/fire wood and braced with teak wood battens fitted with brass screws and washers in slots complete with metallic disc of 160 mm dia at base and confirming to BIS2539:1963;accessories comprising of magnetic trough compass confirming to BIS1764:1961,spirit level 15 cm long, plumb bob , 28cm long brass Ufork, alidade 45 cm long made of brass, one sided beveled edged wooden stand with metallic head and shoes.	10 sets
10	Telescopic Alidade size 175mm Internal focusing vertical circle graduated to read 30min with vernier, extendable base plate to 375mm and half degree divided giving angle of elevation and depression spirit level mounted on top telescope, telescope fitted with stadia diaphragm, vertical circle, to be supplied in teak wood box fully protected from dust	06
11	Automatic Level (as per BIS:4590) Telescope: Aperture of objective 45mm Field view1020' Magnification 32X Stadia Ratio 1:100 Addition Constant 0(zero) Minimum Focusing Distance1.5mm Range250meters Circular level with sensitivity per 2mm run10' mounted on sides of the telescope Accessories: Maintenance tools Leveling : Speedy Leveling by ball and socket arrangement. Tilting screw for final leveling Teak wood box, Tripod stand made of seasoned timber rigid with metal shoes	06
12	Leveling Staff: Aluminium-4 meter long in telescopic accurately painted in red and black on white background as per BIS 1779 and push type automatic locking system in canvas cover. Least Count- 0.005m /0.01m	06