

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

**TEACHING AND EVALUATION SCHEME FOR 5th Semester (Civil Engineering)(wef 2020-21)**

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		Entrepreneurship and Management & Smart Technology	4		-	20	80	3	100
Th.2		Structural Design-II	4		-	20	80	3	100
Th.3		Railway & Bridge Engineering	4		-	20	80	3	100
Th.4		Water Supply & Waste Water Engineering	5			20	80	3	100
Th.5		Estimating & Cost Evaluation- II	4			20	80	3	100
		<i>Total</i>	21			100	400	-	500
<b>Practical</b>									
Pr.1		Civil Engineering. Lab-II	-	-	6	50	100	3	150
Pr.2		Estimating Practice-II (Computer-Aided)	-	-	3	25	50	3	75
Pr.3		Project Phase-I	-	-	6	25	-	-	25
		Student Centred Activities(SCA)			3				
				-		-	-	-	-
		<i>Total</i>	-	-	18	100	150	-	250
		<b>Grand Total</b>	<b>21</b>	<b>-</b>	<b>18</b>	<b>200</b>	<b>550</b>	<b>-</b>	<b>750</b>

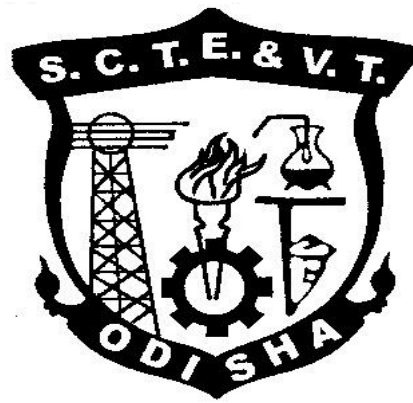
Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

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 5<sup>TH</sup> SEMESTER**  
**For**  
**DIPLOMA IN CIVIL ENGINEERING**  
**(Effective FROM 2020-21 Sessions)**



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

**Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY**  
(Common to All Branches)

<b>Theory</b>	<b>4 Periods per week</b>	<b>Internal Assessment</b>	<b>20 Marks</b>
<b>Total Periods</b>	<b>60 Periods</b>	<b>End Sem Exam</b>	<b>80 Marks</b>
<b>Examination</b>	<b>3hours</b>	<b>Total Marks</b>	<b>100Marks</b>

**Topic Wise Distribution of Periods**

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	<b>TOTAL</b>	<b>60</b>

**RATIONALE**

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

*In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.*

**OBJECTIVES**

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

**DETAILED CONTENTS**

**1. Entrepreneurship**

- Concept /Meaning of Entrepreneurship
- Need of Entrepreneurship
- Characteristics, Qualities and Types of entrepreneur, Functions
- Barriers in entrepreneurship
- Entrepreneurs vrs. Manager

- Forms of Business Ownership: Sole proprietorship, partnership forms and others
- Types of Industries, Concept of Start-ups
- Entrepreneurial support agencies at National, State, District Level( Sources): DIC, NSIC, OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
- Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

## 2. **Market Survey and Opportunity Identification (Business Planning)**

- Business Planning
- SSI, Ancillary Units, Tiny Units, Service sector Units
- Time schedule Plan, Agencies to be contacted for Project Implementation
- Assessment of Demand and supply and Potential areas of Growth
- Identifying Business Opportunity
- Final Product selection

## 3. **Project report Preparation**

- Preliminary project report
- Detailed project report, Techno economic Feasibility
- Project Viability

## 4. **Management Principles**

- Definitions of management
- Principles of management
- Functions of management (planning, organising, staffing, directing and controlling etc.)
- Level of Management in an Organisation

## 5. **Functional Areas of Management**

### a) Production management

- Functions, Activities
- Productivity
- Quality control
- Production Planning and control

### b) Inventory Management

- Need for Inventory management
- Models/Techniques of Inventory management

### c) Financial Management

- Functions of Financial management
- Management of Working capital
- Costing (only concept)
- Break even Analysis
- Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)

### d) Marketing Management

- Concept of Marketing and Marketing Management
- Marketing Techniques (only concepts)
- Concept of 4P s (Price, Place, Product, Promotion)

### e) Human Resource Management

- Functions of Personnel Management
- Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages

## 6. **Leadership and Motivation**

### a) Leadership

- Definition and Need/Importance
- Qualities and functions of a leader
- Manager Vs Leader
- Style of Leadership (Autocratic, Democratic, Participative)

### b) Motivation

- Definition and characteristics
- Importance of motivation
- Factors affecting motivation
- Theories of motivation (Maslow)
- Methods of Improving Motivation
- Importance of Communication in Business
- Types and Barriers of Communication

## 7. **Work Culture, TQM & Safety**

- Human relationship and Performance in Organization
- Relations with Peers, Superiors and Subordinates
- TQM concepts: Quality Policy, Quality Management, Quality system
- Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)

## 8. **Legislation**

- a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
- b) Features of Factories Act 1948 with Amendment (only salient points)
- c) Features of Payment of Wages Act 1936 (only salient points)

## 9. **Smart Technology**

- Concept of IOT, How IOT works
- Components of IOT, Characteristics of IOT, Categories of IOT
- Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

**Syllabus to be covered before IA:** Chapter 1,2,3,4

## **RECOMMENDED BOOKS**

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. <https://www.fundable.com/learn/resources/guides/startup>

## Th2. STRUCTURAL DESIGN– II

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment :	20
Maximum marks:	100	End Semester examination:	80

### A. RATIONALE

The course aims at imparting skills to design structural members. This will enable the students to recognize the load conditions and possible failure locations so that student will be able to compute necessary dimensions to prevent failure.

### B. COURSE OBJECTIVES

On completion of the course, a student will be able to-

1. Design simple steel structure such as tension members, compression members and simple beams.
2. Design timber structural elements
3. Design staircase, footings by limit method of design.
4. Draw the details of a steel roof truss.
5. Draw the reinforcement details of underground RCC water tank and RCC footings.
6. Use standards and design codes.

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
1	Introduction:	5
2	Structural Steel Fasteners and Connections.	10
3	Design of Steel tension Members	10
4	Design of Steel Compression members.	10
5	Design of Steel beams:	10
6	Design of Tubular Steel Structures	6
7	Design of Masonry Structures	9

### D. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

- 1 Introduction:**
  - 1.1 Common steel structures, Advantages & disadvantages of steel structures.
  - 1.2 Types of steel, properties of structural steel.
  - 1.3 Rolled steel sections, special considerations in steel design.
  - 1.4 Loads and load combinations.
  - 1.5 Structural analysis and design philosophy.
  - 1.6 Brief review of Principles of Limit State design.
- 2 Structural Steel Fasteners and Connections.**
  - 2.1 Bolted Connections
    - 2.1.1 Classification of bolts, advantages and disadvantages of bolted connections.

- 2.1.2 Different terminology, spacing and edge distance of bolt holes.
- 2.1.3 Types of bolted connections.
- 2.1.4 Types of action of fasteners, assumptions and principles of design.
- 2.1.5 Strength of plates in a joint, strength of bearing type bolts (shear capacity & bearing capacity), reduction factors, and shear capacity of HSFG bolts.
- 2.1.6 Analysis & design of Joints using bearing type and HSFG bolts (except eccentric load and prying forces)
- 2.1.7 Efficiency of a joint.
- 2.2 Welded Connections:
  - 2.2.1 Advantages and Disadvantages of welded connection
  - 2.2.2 Types of welded joints and specifications for welding
  - 2.2.3 Design stresses in welds.
  - 2.2.4 Strength of welded joints.

**3 Design of Steel tension Members**

- 3.1 Common shapes of tension members.
- 3.2 Maximum values of effective slenderness ratio.
- 3.4 Analysis and Design of tension members. (Considering strength only and concept of block shear failure.)

**4 Design of Steel Compression members.**

- 4.1 Common shapes of compression members.
- 4.2 Buckling class of cross sections, slenderness ratio
- 4.3 Design compressive stress and strength of compression members.
- 4.4 Analysis and Design of compression members (axial load only).

**5 Design of Steel beams:**

- 5.1 Common cross sections and their classification.
- 5.2 Deflection limits, web buckling and web crippling.
- 5.3 Design of laterally supported beams against bending and shear.

**6 Design of Tubular Steel Structures:**

- 6.1 Round Tubular Sections, Permissible Stresses
- 6.2 Tubular Compression & Tension Members
- 6.3 Joints in Tubular trusses

**7 Design of Masonry Structures:**

- 7.1 Design considerations for Masonry walls & Columns, Load Bearing & Non-Load Bearing walls, Permissible stresses, Slenderness Ratio, Effective Length, Height & Thickness.

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

**F. BOOKS RECOMMENDED**

Sl. No	Name of Authors	Titles of Book	Name of Publisher
1	B.N.Duggal	Design of Steel Structures	McGraw Hill Education
2	Samal & Panigrahi	Elements of Steel ,Timber & Masonry Design	Kalyani Pbln
3	Samal & Panigrahi	Steel Tables	Kalyani Pbln
4	BIS.	1) I.S 800-Code of practice for General construction in steel	BIS

		<p>2) SP-20 Hand book on masonry design and construction- BIS Publication.</p> <p>3) IS 806: 1968 Code of practice for use of steel tubes in general building construction.</p> <p>4) IS 1161: 1998 Steel Tubes for Structural Purposes – Specification</p>	
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## Th3. RAILWAY & BRIDGE ENGINEERING

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	5 <sup>th</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

### A. RATIONALE

The course will expose the students to the requirements posed by railways and bridges and how these requirements are different from roads. The course shall acquaint the students with common engineering terminology and prepares them to pursue higher courses in the aspect.

### B. COURSE OBJECTIVES

On completion of the course, students will be able to

1. Explain railway terminology
2. Comprehend the track components and relate to the material or geometric aspects that can be used for these
3. Describe methods of laying and maintaining the track
4. State the requirements for an ideal bridge and describe types of foundation and substructures
5. Classify the bridges and identify the components
6. Select the bridge sites in context of hydrologic requirements

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
1	Introduction	2
2	Permanent way	5
3	Track materials	10
4	Geometric for broad gauge	10
5	Points and crossings	4
6	Laying & maintenance of track	4
Section – B: BRIDGES		
1	Introduction to bridges	2
2	Bridge site investigation, hydrology & planning	5
3	Bridge foundation	8
4	Bridge substructure and approaches	5
5	Culvert & Cause Ways	5

### D. COURSE CONTENTS:

#### Section – A: RAILWAYS

- 1 Introduction**
  - 1.1 Railway terminology
  - 1.2 Advantages of railways
  - 1.3 Classification of Indian Railways
  
- 2 Permanent way**
  - 2.1 Definition and components of a permanent way
  - 2.2 Concept of gauge, different gauges prevalent in India, suitability of these gauges

under different conditions

**3**

**Track materials**

3.1 Rails

3.1.1 Functions and requirement of rails

3.1.2 Types of rail sections, length of rails

3.1.3 Rail joints – types, requirement of an ideal joint

3.1.4 Purpose of welding of rails & its advantages

3.1.5 Creep- definition, cause & prevention

3.2 Sleepers

3.2.1 Definition, function & requirements of sleepers

3.2.2 Classification of sleepers

3.2.3 Advantages & disadvantages of different types of sleepers

3.3 Ballast

3.3.1 Functions & requirements of ballast

3.3.2 Materials for ballast

3.4 Fixtures for Broad gauge

3.4.1 Connection of rails to rail-fishplate, fish bolts

3.4.2 Connection of rails to sleepers

**4**

**Geometric for broad gauge**

4.1 Typical cross – sections of single & double broad gauge railway track in cutting and embankment

4.2 Permanent & temporary land width

4.3 Gradients for drainage

4.4 Super elevation – necessity & limiting valued

**5**

**Points and crossings**

5.1 Definition, necessity of Points and crossings

5.2 Types of points & crossings with tie diagrams

**6**

**Laying & maintenance of track**

6.1 Methods of Laying & maintenance of track

6.2 Duties of a permanent way inspector

**Section – B: BRIDGES**

**1**

**Introduction to bridges**

1.1 Definitions

1.2 Components of a bridge

1.3 Classification of bridges

1.4 Requirements of an ideal bridge

**2**

**Bridge site investigation, hydrology & planning**

2.1 Selection of bridge site, Alignment,

2.2 Determination of Flood Discharge

2.3 Waterway & economic span

2.4 Afflux, clearance & free board

**3**

**Bridge foundation**

3.1 Scour depth minimum depth of foundation

3.2 Types of bridge foundations – spread foundation, pile foundation- well foundation – sinking of wells, caisson foundation

3.3 Cofferdams

**4 Bridge substructure and approaches**

4.1 Types of piers

4.2 Types of abutments

4.3 Types of wing walls

4.4 Approaches

**Culvert & Cause ways**

**5** 5.1 Types of culverts – brief description

5.2 Types of causeways – brief description

**E. SYLLABUS COVERGE UPTO INTERNAL ASSESSMENT**

Chapters 1,2,3,4 of Section A & Chapters 1,2 of Section B

**F. Recommended Books**

<b>Sl. No</b>	<b>Name of Authors</b>	<b>Titles of Book</b>	<b>Name of Publisher</b>
1	Chandra & Agrawal	Railway Engineering	Oxford Publication
3	S.C.Sexena & S.P.Arora	A Text book of Railway Engineering	Dhanpat Rai Publications
4	S. C. Rangwala	Railway Engineering	Charotar Publication
5	S.P. Bindra	Bridge Engineering	Dhanpat Rai Publications

## Th4. WATER SUPPLY AND WASTE WATER ENGINEERING

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	5 <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 aims to expose the students to the current state of water supply and sewage disposal system. Through the course the principles, purposes and the methods are covered at different stages of the activity, thus laying foundation in students to think of meeting futuristic challenges.

### B. COURSE OBJECTIVES

On completion of the course, students will be able to

1. Compute water demand in terms of quantity and quality
2. Describe the water sources, conveyance and distribution system
3. Realize the necessity of treatment and comprehend the principle and purpose of different water treatment processes
4. Comprehend the terminology relating to sanitary engineering and compute quantity & quality of sewage
5. Describe the sewerage system and its components stating the purposes thereof
6. Comprehend the necessity and method of sewage treatment and disposal

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
SECTION A: WATER SUPPLY		
1	Introduction to Water Supply, Quantity and Quality of water	10
2	Sources and Conveyance of water	8
3	Treatment of water	12
4	Distribution system and Appurtenance in distribution system	8
5	W/s plumbing in building	2
SECTION B: WASTE WATER ENGINEERING		
6	Introduction	5
7	Quantity and Quality of sewage	7
8	Sewerage system	5
9	Sewer appurtenances and Sewage Disposal	7
10	Sewage treatment	8
11	Sanitary plumbing for building	3

### D. COURSE CONTENTS:

#### SECTION A: WATER SUPPLY

#### 1 Introduction to Water Supply, Quantity and Quality of water

- 1.1 Necessity of treated water supply
- 1.2 Per capita demand, variation in demand and factors affecting demand

- 1.3 Methods of forecasting population, Numerical problems using different methods
- 1.4 Impurities in water – organic and inorganic, Harmful effects of impurities
- 1.5 Analysis of water –physical, chemical and bacteriological
- 1.6 Water quality standards for different uses

## **2 Sources and Conveyance of water**

- 2.1 Surface sources – Lake, stream, river and impounded reservoir
- 2.2 Underground sources – aquifer type & occurrence – Infiltration gallery, infiltration well, springs, well
- 2.3 Yield from well- methods of determination, Numerical problems using yield formulae ( deduction excluded)
- 2.4 Intakes – types, description of river intake, reservoir intake, canal intake
- 2.5 Pumps for conveyance & distribution – types, selection, installation.
- 2.6 Pipe materials – necessity, suitability, merits & demerits of each type
- 2.7 Pipe joints – necessity, types of joints, suitability, methods of jointing  
Laying of pipes – method

## **3 Treatment of water**

*Note:*

- 1. *Design of treatment units excluded.*
- 2. *Students may be asked to prepare detailed sketches of units, preferably from working drawing, as home assignment*
- 3. *Field visit to treatment plant, under practical should be arranged after covering this unit.*

3.1 Flow diagram of conventional water treatment system

3.2 Treatment process / units :

- 3.2.1 Aeration ; Necessity
- 3.2.2 Plain Sedimentation : Necessity, working principles, Sedimentation tanks – types, essential features, operation & maintenance
- 3.2.3 Sedimentation with coagulation: Necessity, principles of coagulation, types of coagulants, Flash Mixer, Flocculator, Clarifier (Definition and concept only)
- 3.2.4 Filtration : Necessity, principles, types of filters  
Slow Sand Filter, Rapid Sand Filter and Pressure Filter – essential features
- 3.2.5 Disinfection : Necessity, methods of disinfection  
Chlorination – free and combined chlorine demand, available chlorine, residual chlorine, pre-chlorination, break point chlorination, super-chlorination
- 3.2.6 Softening of water – Necessity, Methods of softening – Lime soda process and Ion exchange method (Concept Only)

## **4 Distribution system And Appurtenance in distribution system:**

- 4.1 General requirements, types of distribution system-gravity, direct and combined
- 4.2 Methods of supply – intermittent and continuous
- 4.3 Distribution system layout – types, comparison, suitability
- 4.4 Valves-types, features, uses, purpose-sluice valves, check valves, air valves, scour valves, Fire hydrants, Water meters

## **5 W/s plumbing in building :**

- 5.1 Method of connection from water mains to building supply
- 5.2 General layout of plumbing arrangement for water supply in single storied and multi-storied building as per I.S. code.

## SECTION B: WASTE WATER ENGINEERING

- 6 Introduction**  
6.1 Aims and objectives of sanitary engineering  
6.2 Definition of terms related to sanitary engineering  
6.3 Systems of collection of wastes– Conservancy and Water Carriage System – features, comparison, suitability
- 7 Quantity and Quality of sewage**  
7.1 Quantity of sanitary sewage – domestic & industrial sewage, variation in sewage flow, numerical problem on computation quantity of sanitary sewage.  
7.2 Computation of size of sewer, application of Chazy's formula, Limiting velocities of flow : self-cleaning and scouring  
7.3 General importance, strength of sewage, Characteristics of sewage-physical, chemical & biological  
7.4 Concept of sewage-sampling, tests for – solids, pH, dissolved oxygen, BOD, COD
- 8 Sewerage system**  
8.1 Types of system-separate, combined, partially separate , features, comparison between the types, suitability  
8.2 Shapes of sewer – rectangular, circular, avoid-features, suitability  
8.3 Laying of sewer-setting out sewer alignment
- 9 Sewer appurtenances and Sewage Disposal:**  
9.1 Manholes and Lamp holes – types, features, location, function  
9.2 Inlets, Grease & oil trap – features, location, function  
9.3 Storm regulator, inverted siphon – features, location, function  
9.4 Disposal on land – sewage farming, sewage application and dosing, sewage sickness-causes and remedies  
9.5 Disposal by dilution – standards for disposal in different types of water bodies, self purification of stream
- 10 Sewage treatment :**  
**(Note: 1.Design of treatment units excluded.**  
**2.Students may be asked to prepare detailed sketches of units, preferably from working drawing, as home assignment.**  
**3.Field visit to treatment plant, under practical should be arranged after covering this unit.)**  
10.1 Principles of treatment, flow diagram of conventional treatment  
10.2 Primary treatment – necessity, principles, essential features, functions  
10.3 Secondary treatment – necessity, principles, essential features, functions
- 11 Sanitary plumbing for building :**  
11.1 Requirements of building drainage, layout of lavatory blocks in residential buildings, layout of building drainage  
11.2 Plumbing arrangement of single storied & multi storied building as per I.S. code practice  
11.3 Sanitary fixtures – features, function, and maintenance and fixing of the fixtures – water closets, flushing cisterns, urinals, inspection chambers, traps, anti-syphonage pipe

## E. SYLLABUS COVERGE UPTO INTERNAL ASSESSMENT

Chapters 1, 2, 3, 4 from Section A & Chapters 6,7,8 from Section B

## F. RECOMMENDED BOOKS

Sl. No	Name of Authors	Titles of Book	Name of Publisher
1	G.S.Birdie	Text book on water supply and sanitary engineering	Dhanpat Rai Publications
2	S.K.Garg	Water Supply Engineering	Khanna Publishers
3	S.K.Garg	Waste Water Disposal Engg.	Khanna Publishers
4	By Ministry of Urban Development, Govt. of India.	CPHEEO manual Water supply	
5	By Ministry of Urban Development, Govt. of India.	CPHEC Mannual- Sewage & Sewage Treatment - by Ministry of Urban Development, Govt. of India.	

## Th5. ESTIMATION & COST EVALUATION – II

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

### A. RATIONALE

The course exposes the students to the techniques and best practices to prepare detailed estimates of roads, bridges, culverts, irrigation structures and PWD works.

### B. COURSE OBJECTIVES

On completion of the course, students will be able to

1. Create detailed estimate of culverts and bridges
2. Prepare estimates of irrigation structures
3. Prepare estimates of a macadam road and a national highway in cutting and filling
4. Prepare detailed estimates for septic tank and soak pits
5. Prepare detailed estimates of miscellaneous works
6. Comprehend the management practices in Public Works Department
7. Interpret the building bylaws furnished by regulatory bodies

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
1.	Detailed estimate of culverts and bridges	12
2.	Estimate of irrigation structures	14
3.	Detailed estimate of roads	12
4.	Detailed estimates of miscellaneous works	12
5.	PWD accounts works	10

### D. COURSE CONTENTS:

#### 1. Detailed estimate of culverts and bridges

- 1.1 Detailed estimate of a RCC slab culvert with right angled wing walls with bar bending schedule.
- 1.2 RCC Hume pipe culvert with splayed angled wing wall

#### 2. Estimate of irrigation structures

- 2.1 Detailed estimate of simple type of vertical fall to given specification
- 2.2 Detailed estimate of drainage siphon to given specification.

#### 3. Detailed estimate of roads

- 3.1 Detail estimate of a water bound macadam road
- 3.2 Detailed estimate of a flexible pavement in cutting / filling
- 3.2 Detailed estimate of septic tank and soak pit for 50 users

#### 4. Miscellaneous estimates



4.1 Tube well, Piles and Pile cap, Isolated and combined footings.

## 5. PWD Accounts works

### 5.1 Works

5.1.1 Classification of work-original, major, petty, repair work, annual repair, special repair, quadrantal repair.

5.1.2 Concept of Method of execution of works through the contractors and department, contract and agreement, work order, types of contract, piece work agreement.

### 5.2 Accounts of works –

#### 5.2.1 Explanation of various terms

Administrative approval, technical sanction, tender, preparation of notice inviting tender, quotations, earnest money, E-tendering, security deposit, advance payment, intermediate payment, final payment, running bill, final bill, regular and temporary establishment, cash, major & subhead of account, temporary advance (imprest money), supervision charges, suspense account, debit, credit, book transfer, voucher and related accounts .

5.2.2 Measurement book use & maintenance, procedure of marking entries of measurement of work and supply of materials, labour employed, standard measurement books and common irregularity

5.2.3 Muster roll : Its preparation & use for making payment of pay & wages

5.2.4 Acquittance Roll : Its preparation & use for making payment of pay & wages

5.2.5 Labour & labour report, method of labour payment, use of forms and necessity of Submission

5.2.6 Classification of stores, receipt / issue statement on standard form, method of preparation of stock account, preparation and submission of returns, verification of stocks, shortage and excess

5.3 Building BYLAWS and REGULATORY Bodies, Development authorities, types and their levels, RERA etc.

## E. SYLLABUS COVERGE UPTO INTERNAL ASSESSMENT

Chapters 1, 2, 3

## F. RECOMMENDED BOOKS

Sl. No	Name of Authors	Titles of Book	Name of Publisher
1	M.Chakraborty.	Estimating, Costing, specification & Valuation in Civil Engineering	Published by author
2	B.N.Dutta.	Estimating & Costing	UBSPD
3	Birdi & Ahuja.	Estimating & Costing	Dhanpat Rai Publication
4	Latest Orissa PWD Schedule of Rates & Analysis of rates		Govt. of Odisha

## Pr1. CIVIL ENGINEERING LABORATORY-II

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	5th
Total Period:	90	Examination	3 hrs
Practical periods:	6P/week	Sessional Marks:	50
Maximum marks:	150	Practical Examination:	100

### A. RATIONALE

The course aims to develop competence in conduct of experiments in line with prescribed standards and interpret the results. The objective is to enable the students gathering professional skills in working at research and testing laboratories. In the course students are required to conduct at least fifteen experiments selecting minimum three from each of the section furnished in course contents.

### B. COURSE OBJECTIVES

On completion of the course students will be able to

1. Prepare setups and specimens for experiments
2. Interpret the specimen specifications prescribed in standard test manuals and codes
3. Acquaint themselves with modern test equipment
4. Record the results in prescribed formats
5. Plot graphs and interpret the results
6. Analyze the results and predict possible trends

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Chapter	Name of topics	Hours
1.	TESTS ON SOIL	36
2.	HYRAULICS LABORATORY	18
3.	TRANSPORTATION LABORATORY	18
4.	PUBLIC HEALTH ENGINEERING LABORATORY	18

### D. COURSE CONTENTS

#### 1.0 TESTS ON SOIL :

- 1.1 Determination of Specific gravity of Soil by Pycnometer /Density bottle.
- 1.2 Determination of Field Density of Soil by Core Cutter Method.
- 1.3 Determination of Particle Size gradation of sand/Gravel by sieve analysis.
- 1.4 Wet mechanical analysis using pipette method for clay and silt.
- 1.5 (a)Determination of Liquid Limit by soil by Casagrande's apparatus.  
(b)Determination of Plastic limit of soil.
- 1.6 Determination of Shrinkage limit of soil.
- 1.7 Determination of MDD & OMC of soil by using modified Proctor Test.
- 1.8 Determination of CBR value using Laboratory CBR Testing device.
- 1.9 Determination of  $c$  and  $\phi$  of soil by triaxial testing device.
- 1.10 Determination of coefficient of permeability of soil by constant head method.

## **2.0 HYRAULICS LABORATORY:**

- 2.1 Verification of Bernoulli's Theorem
- 2.3 Determination of coefficient of Discharge of a rectangular notch fitted in open Channel.
- 2.3 Determination of coefficient of Discharge of a Venturimeter, Orificemeter fitted in a pipe
- 2.4 Determination of head Loss due to friction and coefficient of friction for flow through pipe.

## **3.0 TRANSPORTATION LABORATORY:**

- 3.1 Penetration Test of Bitumen.
- 3.2 Ductility Test of Bitumen.
- 3.3 Viscosity Test of Bitumen.
- 3.4 Bitumen content by centrifuge extractor.

## **4.0 PUBLIC HEALTH ENGINEERING LABORATORY:**

- 4.1 Determination of Turbidity of water Sample using Turbidimeter/Nephelometer/Jackson's Candle Turbidimeter.
- 4.2 Determination of pH of Water sample using (a) pH – meter (b) colour Comparator.
- 4.3 Determination of Chloride content of a Water sample using method of titration.
- 4.4 Determination of Coagulant (Alum) dose requirement for a turbid water sample by Jar Test.
- 4.5 Determination of dissolved oxygen in a water sample.
- 4.6 Determination of bacteriological quality of water sample by Coliform test.

## **E. Recommended Books**

- |   |                                |
|---|--------------------------------|
| 1. Soil Testing                                     | -A. P. Mittal                  |
| 2. Civil Engineering laboratory Practice-II         | - Dr. M.R. Samal, Kalyani Pbln |
| 3. Highway material testing Laboratory manual       | -S.K.Khanna &C.E.G.Justo.      |
| 4. Laboratory manual in Highway material testing    | -Ajay K. Duggal,Vijaya p.      |
| 5. Laboratory work in Hydraulic Engineering         | -G.L.Asawa.                    |
| 6. Experimental Hydraulics                          | -S.N. Ghosh & S.C Talapatra.   |
| 7. Laboratory manual in Environmental Engineering   | -Prof.P.D.Kulkarni.            |
| 8. Experimental Hydraulics                          | - S.N. Ghosh &S.C Talapatra,   |
| 9. Hydraulics Laboratory Manual                     | - S.K.Likhi.                   |
| 10. Priciples, Practice and design of Highway Engg. | - S.K.Sharma – S.Chand         |

## **Pr2. ESTIMATING PRACTICE – II** **(Computer -Aided)**

Name of the Course: Diploma in Civil Engineering			
Course code:		Semester	5th
Total Period:	45	Examination	3 hrs
Practical periods:	3P/week	Sessional Examination:	25
Maximum marks:	75	Practical Examination	50

Detailed estimate from working drawings / standard drawings as mentioned at Sl. No. 1, 2 , 3 & 4 of theory – 4 Estimation & Cost Evaluation – II)are to be taken in the practical classes using excel sheets.(Computer aided).

<b>Learning Resources</b>			
<b>Text Books</b>			
<b>Sl. No</b>	<b>Name of Authors</b>	<b>Titles of Book</b>	<b>Name of Publisher</b>
1	M.Chakraborty.	Estimating, Costing, specification & Valuation in Civil Engineering	Published by author
2	B.N.Dutta.	Estimating & Costing	UBSPD
3	Birdi & Ahuja.	Estimating & Costing	Dhanpat Rai Publications
4	Latest Orissa PWD Schedule of Rates & Analysis of rates		Govt. of Odisha

## Pr 3. PROJECT WORK (Phase-I)

Name of the Course: Diploma in Civil			
Course code:		Semester	5 <sup>th</sup>
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	25
		TOTAL Marks	25

### RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of civil engineering practices in real life situations, so as to participate and manage a large civil engineering projects in future.

Entire Project shall spread over 5<sup>th</sup> and 6<sup>th</sup> Semester. Part of the Project covered in 5<sup>th</sup> Semester shall be named as *Project Phase-I* and balance portion to be covered in 6<sup>th</sup> Semester shall be named as *Project Phase-II*.

### OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop civil engineering knowledge and applications in implementing these for the actual needs of the community/industry.
- Explain the working of industrial environment and its work ethics.
- Explain what entrepreneurship is and how to become an entrepreneur.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Field computing and to achieve real life experience in civil engineering planning, designing and execution.
- To develop the skill of writing Project Report

### General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5<sup>th</sup> semester). Students should be allotted a problem of interest to him/her as a project work. It is also

essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 5 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Qualitative analysis of any one or more of the civil engineering materials by addition or alteration of one or more constituents to assess their suitability as construction materials.
- ✓ Characterization of one or more locally available/recently developed civil engineering materials
- ✓ Experimental investigation of behavior of structural elements.
- ✓ Preparation of innovative structural models by use of materials having close resemblance to real life structures.
- ✓ Qualitative and/or Quantitative analysis of Physio-chemical characteristics of water from one or more sources of water.
- ✓ Analysis, design and/or estimation of civil engineering structures. Use of software for execution of projects may be encouraged.
- ✓ Planning, testing and execution of construction project.
- ✓ Soil properties enhancement using different available materials.
- ✓ Development of Waste disposal system including e-waste.
- ✓ Application of different surveying techniques for solving real world problem.
- ✓ Traffic volume studies and congestion solution.
- ✓ Any other related area found worth.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

### **Project Phase-I and Phase-II**

The Project work duration shall cover 2 semesters(5<sup>th</sup> and 6<sup>th</sup> sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5<sup>th</sup> sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work upto Design of the system have to be complete in Phase-I. Execution of work may begin in Phase-I depending on the Project. Project Milestones are to be set so that progress can be tracked . In Phase-II Execution of work and Documentation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-I in 5<sup>th</sup> semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

**CIVIL ENGINEERING LABORATORY – II (FOR A GROUP OF 30 STUDENTS)**

Sl. No.	Name of the experiment	Name of apparatus required with detailed specification	Quantity required in No.
<b>Soil Testing Equipments</b>			
1	Determination of Water content of Soil by Oven drying method.	Metal Container or moisture can with lid(air tight non corrodible)suitable for 15 to 20g soil	5NOS
		Digital Weighing balance (0.01gm sensitivity) nearly 500gm capacity	2NOS
		Oven- Thermostatically controlled with interior of non–corroding material to maintain temperature at $110 \pm 5^{\circ}\text{C}$ .	1NO
		Descicators	1NO
		Tongs(One Pair)	5PAIRS
2	Determination of Specific gravity of Soil by Pycnometer/Density bottle.	Pycnometer	5NOS
		Density bottle	5NOS
		Vaccum descicators.	1NO
		Digital Weighing balance	2NOS
		Thermometer	1NO
		Glass rod	5NOS
		Sample divider of the multiple slot type (riffle box)	1 NO
3	Determination of Field Density of Soil by Core Cutter Method.	Cylindrical core cutter	4NOS
		Steel Rammer (with	4NOS
		Steel dolly	4NOS
		Digital Balance	2NOS
		Steel Rule.	4NOS
		Straight edge	4NOS
		Palette Knife	4NOS
4	Determination of Particle Size gradation of sand/Gravel by sieve analysis	(a) I.S.Sieves (GI, 450 mm dia.)- 100mm,75mm,40mm,25mm,19mm,12.5mm,10mm,6.5 mm, 4.75mm)	2 SETS
		(b) I.S.Sieves (Brass, 200mm dia)2.00mm,850 $\mu$ ,600 $\mu$ , 425 $\mu$ ,300 $\mu$ ,150 $\mu$ ,75 $\mu$ with lid and pan.	2 SETS
		Digital Weighing balance	2NOS
		Rubber pestle and motar	
		Mechanical Sieve Shaker	2 SETS
		Mechanical Sieve Shaker	2 SETS
5	Wet mechanical analysis using pipette method for clay and silt.	Pipete	4 NOS
		Cylinder/jars	5 NOS
		Mechanical stirrer	6 NOS
		Glass weighing bottles	7 NOS
		Digital Balance-	NIL
		Thermometer	1
6	Determination of	Water bath -	2NOS
		Casagrande’s liquid limit device with grooving tools	5NOS



	Liquid Limit by soil by Casagrande's apparatus	Moisture can with lid	5NOS
		Porcelain evaporating dish	5NOS
		Spatula –flexible ,with the blade	5NOS
7	Determination of Plastic limit of soil.	Ground glass plate	4NOS
		3 mm dia glass rod	4NOS
		425 $\mu$ I.S. sieve	1NO
8	Determination of Shrinkage limit of soil.	Steel shrinkage dish –	8NOS
		Glass cup	4NOS
		Prong plate	4NOS
		Plain plate	4NOS
		Spatula	4NOS
		Straight edge	4NOS
		Mercurry	2 KG
		Porcelain evaporating dishes	4NOS
9	Determination of Coefficient of permeability of course grained soils under constant head method.	Permeameter mould of non-corrodible material	One set consist of all the above items
		Accassories of permeameter mould detachable collar ,porous stones (2 No.), dummy base plate etc.	
		Compaction rammer	
		Whatman Filter paper	
		Beaker	
		Drying crucible.	
		GI tray	
		Stop watch.	
		Glass Measuring cylinder	
		Reservoir/Over head tank	
10	Determination of MDD & OMC of soil by using modified Proctor Test	(a) Compaction moulds – cylindrical mould of capacity 1000 cc, internal diameter 100 mm ,effective height 127.3mm	One set consist of all the above items
		(b) Cylindrical mould of - 2250cc, internal diameter 150 mm, effective height 127.3mm	
		Metal rammers – (a) for light compaction (face diameter 50mm mass of 2.6 kg ,free drop of 310 mm) (b) for heavy compaction (mass =4.89kg ,free fall 450 mm )	
		Mould accessories – (detachable base plate , removable collar )	
		I.S. Sieves- size 19 mm & 4.75 mm, Brass	
		GI tray - 02 No.	
		Drying crucibles-06 Nos.	
		Graduated jars (Glass)	
		Straight edge	
		Spatula	
		11	
Lateral pressure assembly for applying and maintaining desired pressure on the fluid within the cell			
Loading frame			
Proving ring of			

		Split mould of diameter and length to suit the specimen Trimming knife Scale & vernier calliperse. Dial gauge Piano wire saw Metal straight edge Volume change burette 25 cc. Air compressor Metal scale Non-corrodible metal or plastic end caps of the same diameter as the specimen ; the upper cap having a central spherical seating to receive the loading ram Seam less rubber membrane Membrane stretcher Rubber rings	One set consist of all the above items
12	Determination of CBR value using Laboratory CBR Testing device	C.B.R mould Steel cutting edge (collar) which a can fit flush with the mould. Spacer disc Surcharge weight Dial gauge Penetration plunger Loading machine Metal rammer Expansion measuring apparatus – perforated plate with adjustable stem, metal tripod etc.	One set consist of all the above items
<b>Hydraulics Laboratory</b>			
1	Verification of Bernoulli's Theorem	F1-10 hydraulics bench F1-15 Bernoulli's apparatus test equipment A stopwatch for timing the flow measurement.	One set consist of all the above items
2	Determination of coefficient of Discharge of a rectangular notch fitted in open Channel	Rectangular notch, Collecting tank, Constant head tank, Stop watch	One set consist of all the above items
3	Determination of coefficient of Discharge of a Venturimeter, Orificemeter fitted in a pipe	Venturimeter fitted in a horizontal pipe line with means of varying flow rate, U tube differential manometer. Orificemeter fitted in a horizontal pipeline with means of varying flow rate, U tube differential manometer.	Each One set consist of all the above items

4	Determination of head Loss due to friction and coefficient of friction for flow through pipe	F1-10 hydraulics bench	One set consist of all the above items
		F1-18 pipe friction apparatus	
		Stopwatch for timing the flow measurement	
		Measuring cylinder for measuring very low flow rates	
		Spirit level	
		Thermometer	
<b>Transportation Laboratory</b>			
1	Penetration Test of Bitumen	<b>Penetrometer</b> consisting of a needle assembly with a total weight of 100 gram and device for releasing and locking needle in any position.	One set consist of all the above items
2	Ductility Test of Bitumen	<b>Briquette mould:</b> It is made of brass. Circular holes are provided at ends called clips to grip the fixed and movable ends of the testing machine.	One set consist of all the above items
		<b>Water bath:</b> A bath maintained within $27.0^{\circ} \pm 0.1^{\circ} \text{C}$ of the specified test temperature containing not less than 10 litres of water.	
		<b>Testing machine:</b> For pulling the briquette of bituminous material apart, any apparatus may be used which is so constructed that the specimen will be continuously submerged in water while the two clips are being pulled apart horizontally at a uniform speed of $50 \pm 2.5$ mm per minute.	
		<b>Thermometer:</b> Range $0-44^{\circ}\text{C}$ and readable up to $0.2^{\circ}\text{C}$	
3	Viscosity Test of Bitumen	Tar viscometer, cup, valve, receiver, thermometer	One set consist of all the above items
4	Bitumen content by centrifuge extractor	Centrifuge apparatus used for binder content test of bituminous mix	One set consist of all the above items
<b>Public Health Engineering Laboratory</b>			
1	Determination of Turbidity of water Sample using Turbidimeter/Nephelometer/Jackson's Candle Turbidimeter	W.H.O Nephelometric turbidity meter and test tubes	One set consist of all the above items

2	Determination of pH of Water sample using (a) pH – meter (b) colour Comparator	pH meter with electrode, Color comparator with discs	One set consist of all the above items
		Thermometer that can read $77 \pm 18^{\circ}\text{C}$ to the nearest value of 0.1 degree Celsius	
		Glass stirring rod	
		Minimum capacity scale to read up to 1.1 lb	
3	Determination of Chloride content of a Water sample using method of titration	Burette Pipettes Flask Measuring Cylinder	One set consist of all the above items
4	Determination of Coagulant (Alum) dose requirement for a turbid water sample by Jar Test.	Jar test apparatus Glass beaker Pipette pH meter Nephelometer	One set consist of all the above items
5	Determination of dissolved oxygen in a water sample	300 ml capacity bottle with stopper Burette Pipette	One set consist of all the above items
6	Determination of B.O.D of waste water sample by Coliform test	B.O.D. bottle 300ml capacity B.O.D. incubator Air compressor Measuring cylinder Burette pipette	One set consist of all the above items