

Semester 3

Diploma in Civil Engineering — WBSCTVESD Companion

DIPLOMA IN CIVIL ENGINEERING

Semester 3 Companion

Complete exam companion for all theory subjects

**West Bengal State Council of Technical & Vocational
Education and Skill Development**

Syllabus-aligned · Full Time Diploma in Civil Engineering

SUBJECTS COVERED

Surveying · Building Material & Construction · Concrete Technology · Mechanics of Structures
· Hydraulics · Civil Engineering Drawing

6

Theory subjects covered unit by
unit

235

MCQs with full answer keys

190+

Pages of syllabus-mapped con-
tent

WBSCTE Diploma in Civil Engineering — Semester 3 Companion

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NirmaanPro Companion — Semester 3, Diploma in Civil Engineering

Aligned to the syllabus of the **West Bengal State Council of Technical & Vocational Education and Skill Development** (WBSCT&VE&SD), Full Time Diploma in Civil Engineering.

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This companion is a study aid. It condenses and organises the prescribed syllabus for revision and examination practice. It is not a substitute for the prescribed textbooks, the official syllabus document, or the relevant Indian Standard codes. Learners must verify all code clauses, design constants and statutory provisions against the current editions of the relevant IS codes, IRC codes, PWD schedules and Council circulars before using them in practice or in an examination answer. Wherever a numerical value depends on a code table, the source table is named so that the learner can check it.

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Exam Tip

The classification question is nearly always “Classify surveying” for 4–6 marks. Draw a **tree diagram**: Surveying → Primary (Plane, Geodetic) and Secondary (Instrument, Method, Object, Nature of field), with the sub-items branching off. A tree gets full marks in half the writing time of a paragraph.

1.2 Measurement of Horizontal Distance

1.2.1 Introduction

All plan distances are **horizontal** distances. Whatever is measured along the ground must therefore be reduced to the horizontal before it is plotted. This single sentence is the reason for most of the numericals in this unit.

1.2.2 Methods of measuring horizontal distance

Method	Principle	Accuracy / use
Pacing	Counting paces; pace length calibrated over a known distance	1 in 100 to 1 in 200; reconnaissance only
Passometer / Pedometer Odometer (perambulator)	Instrument counts paces automatically Revolutions of a wheel of known circumference	Same as pacing 1 in 200; road reconnaissance
Chaining / taping	Direct measurement with chain or tape	1 in 1000 (chain) to 1 in 10 000 (invar tape)
Tacheometry	Stadia intercept on a staff read through a theodolite	1 in 300 to 1 in 1000; broken ground
EDM / Total Station	Phase or pulse of a modulated electromagnetic wave	1 in 100 000 and better

Direct, optical and electromagnetic

Pacing, odometer and chaining are **direct** methods (the distance is physically traversed). Tacheometry is an **optical** method. EDM is an **electromagnetic** method. Examiners like this three-way grouping.

1.2.3 Chain surveying — principle and accessories

Chain surveying

Chain surveying is the method of surveying in which *only linear measurements* are made in the field; no angular measurement is taken. It is suitable for small, fairly level and open areas with simple detail.

Principle — The principle of chain surveying is **triangulation** — the area is divided into a network of well-conditioned triangles, because a triangle is the only rectilinear figure that can be plotted from the lengths of its three sides alone.

Well-conditioned triangle

A triangle in which no angle is less than 30° and none greater than 120° . The ideal is an equilateral triangle. In a well-conditioned triangle a small error in the measured length produces the smallest

Semester 4

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SUBJECTS COVERED

Advanced Surveying · Geotechnical Engg. I · Transportation Engg. I · Estimating & Costing ·
Irrigation Engineering · Sessional Subjects

6

Subject chapters, unit by unit

261

MCQs with full answer keys

170+

Pages of syllabus-mapped content

CHAPTER 1

Advanced Surveying

Syllabus map and marks distribution

Unit	Topic	Periods	Marks
1	Electronic distance measurement (EDM)	7	8
2	Theodolite survey	12	18
3	Tacheometric survey	7	10
4	Curves	6	10
5	Volume measurement	4	8
6	Aerial survey, remote sensing and GIS	7	8
7	Construction surveying	5	8
Total		48	70

How to attack this paper

Unit 2 alone carries 18 marks and Units 2, 3 and 4 together carry 38 — more than half the paper. All three are numerical and all three follow a fixed recipe. Learn: (i) the traverse computation table (latitude, departure, closing error, Bowditch correction, consecutive and independent co-ordinates), (ii) the two tacheometric distance–elevation formulae, and (iii) the two methods of setting out a simple circular curve. Everything else in the paper is descriptive and can be written in the last hour of revision.

1.1 Electronic Distance Measurement

1.1.1 Introduction and basic concept

Electronic distance measurement

EDM is the measurement of distance by determining the time taken by an electromagnetic wave to travel from an instrument to a reflector and back, or by measuring the *phase difference* between the transmitted and the returned wave. Since the velocity of the wave is known, the distance follows.

The basic relation

$$D = \frac{Vt}{2}$$

where V = velocity of the electromagnetic wave in the atmosphere ($\approx 299\,792.5$ km/s in vacuum, corrected for temperature, pressure and humidity) and t = the total time of travel out and back.

$$V = \frac{c}{n}$$

c = velocity in vacuum, n = refractive index of the atmosphere (about 1.0003).

Semester 5

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Semester 5 Companion

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SUBJECTS COVERED

Building Services & Entrepreneurship · Contracts and Accounts · Transportation Engg. II · Design of RCC Structures · Geotechnical Engg. II · Sessional Subjects

6

Subject chapters, unit by unit

430

MCQs with full answer keys

195+

Pages of syllabus-mapped content

6.6 Quick Revision — Sessional Subjects	187
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Semester 6

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Semester 6 Companion

Complete exam companion — core, electives and sessionals

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SUBJECTS COVERED

Design of Steel Structures · Construction & Disaster Management · Environmental Engineering
· Advanced Construction Techniques · Architectural Practices & Interior Design · Maintenance &
Rehabilitation · Sessional Subjects

7

Subject chapters, unit by unit

730

MCQs with full answer keys

265+

Pages of syllabus-mapped content

1.1.1 Steel as a construction material

Advantages	Disadvantages
Very high strength-to-weight ratio — lighter members and lighter foundations	Susceptible to corrosion ; needs painting, galvanising or coating and periodic maintenance
Ductile ; gives warning before failure and performs well in earthquakes	Loses strength rapidly above about 250°C — poor fire resistance , needs fire protection
Uniform, predictable properties; manufactured under quality control	Members are slender, so buckling governs many designs
Fast erection — members are prefabricated and bolted or welded on site	High initial cost of material and of skilled fabrication
Members can be dismantled, reused and recycled ; 100% recyclable	Requires skilled labour and lifting plant
Easy to strengthen, extend or alter an existing structure	Fatigue under repeated loading
Long spans possible; suits industrial buildings, bridges and towers	Cost fluctuates with the steel market

1.1.2 Types of section and grades of steel

Rolled steel sections (SP-6 Part 1)

Section	Designation	Use
I-section (beam)	ISJB, ISLB, ISMB , ISWB, ISHB	Beams, columns, girders. <i>ISMB 350@52.4 kg/m</i> means an Indian Standard Medium Beam 350 mm deep weighing 52.4 kg per metre
Channel	ISJC, ISLC, ISMC , ISWC	Purlins, built-up members, bracings
Angle — equal and unequal	ISA 100×100×8	Truss members, ties, struts, connections
Tee	ISNT, ISHT	Truss chords, brackets
Channel/plate built-up	—	Heavy columns and girders
Plates, flats and strips	ISPL, ISF	Gussets, base plates, cover plates
Tubes and hollow sections	YST 210/240/310	Trusses, columns, architectural work
Bars — round and square	—	Bracings, sag rods, ties
Cold-formed light-gauge sections	—	Purlins, girts, roof sheeting supports

Grades of structural steel — IS 2062

Grade	f_y (N/mm ²)	f_u (N/mm ²)	Elongation
E250 (Fe410)	250	410	23%
E300 (Fe440)	300	440	22%
E350 (Fe490)	350	490	22%
E410 (Fe540)	410	540	20%
E450 (Fe570)	450	570	20%

f_y falls slightly for thicker plates (above 20 mm and above 40 mm) — read the exact value from IS 2062 Table 1.

Other constants: $E = 2 \times 10^5$ N/mm²; $G = 0.769 \times 10^5$ N/mm²; Poisson's ratio $\mu = 0.3$; coefficient of thermal expansion = $12 \times 10^{-6}/^\circ\text{C}$; unit weight = 78.5 kN/m³.

1.1.3 Loads on a steel structure

Dead load (IS 875 Part 1) — self weight, sheeting, purlins, services; imposed load (Part 2) — including the **roof live load** of 0.75 kN/m² for an inaccessible sloping roof, reduced by 0.02 kN/m² for every

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This sample shows the cover and a content page from each of the four books.

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