West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Construction Automation [CAU]

Part-II (4th Semester)

2023

CURRICULAR STRUCTURE FOR PART – II SECOND SEMESTER (FOURTH SEMESTER) OF THE FULL-TIME DIPLOMA COURSE IN CONSTRUCTION AUTOMATION

SL	SUBJECT CODE	SUBJECT OF STUDY	HOURS PER WEEK			CREDITS
		THEORETICAL PAPERS	LECTURE	TUTORIAL	PRACTICAL	
	CoAPC401	Construction Methods and Equipment Management	3	0	0	3
	CoAPC402	Advanced Surveying	2	0	0	2
	CoAPC403	Theory of Structure and Mechanism	3	0	0	3
	CoAPC404	Geotechnical Engineering	3	0	0	3
	CoAPC405	Design of RCC Structure	3	0	0	3
	CoAPC406	Safety in Construction	2	0	0	2
		LABORATORY/SESSIONAL PAPERS				
	CoAPC407S	Basic Surveying Field Practices	0	0	2	1
	CoAPC408S	Estimating and Costing	0	0	2	1
	CoAPC409S: Construction Automation Lab- II (consisting of following Module with 2 Practical Classes and 1 Credits)					
	CoAPC409S/I	Module-V: Geotechnical Engineering Lab	0	0	2	1
		ELECTIVE & PROJECT				
	CoAPE410	Elective - I: one subject out of Precast and Prestressed Concrete (subject code: CoAPE 409/I)/Rural Construction Technology (subject code: CoAPE 409/II)	3	0	0	3
	CoAPR411S	Minor Project	0	0	4	2
		TOTAL	19	0	10	24

NOTE: -

1. All subjects (theoretical as well as sessional/practical) are full paper with 100 marks in aggregate as per AICTE and WBSCT&VE&SD
2. Basic Surveying Field Practices may also be conducted in 2-3 weeks field work continously instead of having 2 practical class per week for the entire semester.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Construction Methods and Equipment Management	Course Code	CoAPC401
Subject offered in Semester	Fourth	Number of Credits	2(L:2, T:0, P: 0)
Prerequisites		Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Following are the objectives of this course:

- To know the factors affecting equipment selection, planning and utilization.
- To analyze the life of equipment and issues related to replacement.
- To know different types of equipment used in construction works.

Module/ Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/ Group A	Unit I and II
Module B/ Group B	Unit III and IV
Module C/ Group C	Unit V to VII

Course Content:

Unit 1: Introduction, Planning process of equipment – Factors affecting equipment selection, Planning equipment utilization, Equipment utilization chart.

Unit 2: Equipment Life and Replacement Analysis

- Physical life, Profit life, Economic life, Illustrations on determination of economic life of equipment (very simple examples).
- Equipment Replacement analysis- Intuitive method, Minimum cost method, Maximum profit method (basics only).
- Determination of economic life based on equivalent annual cost (using time value concept, very simple problems).

Unit 3: Engineering Fundamentals of Moving Earth – Machine Performance-Required power, Available power, Usable power, rolling resistance, tractive force, co-efficient of traction, Effect of grade on tractive effort, Effect of altitude on performance of IC engines, Performance chart, ways to define payload of equipment.

Unit 4: Earthmoving and Excavating equipment

- Bull Dozers – Bull Dozers-Types of dozer blades, blade adjustments, Blade performance, production estimation.
- Scrapers, Scraper operation, types of scraper, Components of production cycle of scraper and pusher, Illustrations on production estimation of scraper and balancing interdependent machines.
- Front-End loaders –loader attachments, productivity estimation.
- Excavators-Front shovels and backhoes, operation, factors affecting selection, production estimation.
- Trucks – Production cycle, cycle time estimation, Productivity of trucks, balancing interdependent machines.

Unit 5: Piles and Pile driving equipment

- Pile types: Precast and cast in situ piles, pile hammers, principle of pile hammer, factors affecting pile hammer selection.
- Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers.

Unit 6: Lifting equipment

- Cranes, Crane motions, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane.
- Types of cranes-Tower cranes, Factors affecting lifting capacity of crane, Range diagram.

Unit 7: Concreting equipment

- Steps in concrete making process, types of concrete mixer machines.
- Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete.

Suggested learning resources

1. Peurifoy, R., Schexnayder, C., Shapira, A., & Schmitt, R. (2011). “Construction Planning, Equipment, and Methods” (8th ed.). McGraw-Hill.
2. Gransberg, D. D., Popescu, C. M., & Ryan, R. C. (2006). “Construction equipment management for engineers, estimators, and owners” (2nd ed.). CRC Press.
3. Day, D. A., & Benjamin, N. B. H. (1991). “Construction equipment guide” (2nd ed.). John Wiley & Sons.
4. Harris, F. (1994). “Modern construction and ground engineering equipment and methods” (2nd ed.). Pearson Longman.
5. Nunnally, S. W. (2011). “Construction methods and management” (8th ed.). Prentice Hall.
6. Sharma S C and Deodhar S V, Construction Engineering and Management, Khanna Book Publishing, New Delhi
7. Gahlot,P.S. and Dhir, B.M Construction planning and management New Age International (P) Ltd. Publishers, New Delhi.
8. Shrivastava, U.K., Construction planning and management, Galgotia Publication Pvt Ltd. New Delhi
9. Mantri, S., The A to Z of Practical Building Construction and its Management, Satya Prakashan New Delhi
10. Khanna, O.P., Industrial Engineering and management, Dhanpat Rai New Delhi
11. Punmia, B.C. and Khandelwal, K.K., Project Planning and Controlling with PERT and CPM, Laxmi Publications (P)Ltd.
12. Sengupta, B., Guha H., Construction Management and Planning, Tata-McGraw Hill.
13. Harpal, Singh, Construction Management and accounts, Mc-Graw Hill.
14. Sharma, S.C., Industrial Engineering and Management, Khanna Publications, New Delhi
15. Nagarajan, K., Project Management, New Age International Pvt. Ltd.
16. Chitkara, K.K., Construction Project Management- Planning, Scheduling and Controlling, Tata-McGraw Hill, New Delhi
17. Jha, Kumar Neeraj, Construction Project Management, Pearson Publication.
18. Barrie D.S., Professional Construction Management, McGraw Hill, New York.

Course outcomes:

After completing this course, student will be able to:

- Understand the factors affecting equipment selection, planning and utilization.
- Analyze the life of equipment and issues related to replacement.
- Identify different types of equipment used in construction works and the basic theories related to the same.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Name of the Course	Diploma in Construction Automation	Course Code	CoAPC402
Course Title	Advanced Surveying	Number of Credits	2 (L:2, T: 0, P: 0)
Subject offered in Semester	Fourth	Course Category	PC
Prerequisites	NIL	Marks distribution	
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objective: - Following are the objectives of this course:

- ☐ To know methods of Theodolite Surveying and its use.
- ☐ To learn Tacheometric Surveying and Curve Setting.
- ☐ To understand the Principles of Electronic Distance Measurement equipment and Total station and their use.
- ☐ To know the concept of Remote Sensing, GPS and GIS.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I, IV and V
Module B/Group B	Unit II
Module C /Group C	Unit III

Contents:

Unit–I Measurement of Area and Volume

- ☐ Components and use of Digital Planimeter.
- ☐ Calculation of cross section area - i) From field book entry, ii) From plotted Plan -Mid ordinate rule, The average ordinate rule, The trapezoidal rule, Simpson's rule.
- ☐ Computation of volume - i) The trapezoidal rule (Av. End area rule), ii) prismoidal formula.
- ☐ Measurement of volume of reservoir from contour map, volume of earth work involved in highway and canal construction.
- ☐ Simple numerical problems.

Unit– II Theodolite Surveying

- ☐ Definition, Types and uses of Theodolite, Components of transit Theodolite and their functions, Reading the Vernier of transit Theodolite.
- ☐ Technical terms- Swinging the Telescope, Centering, Transiting, Face left, Face right, Changing Face.
- ☐ Fundamental Lines of transit Theodolite and their relationship
- ☐ Temporary adjustment of transit Theodolite.
- ☐ Measurement of horizontal angle- Direct, Repetition and Reiteration method
- ☐ Measurement of magnetic bearing of a line, Prolonging and ranging a line
- ☐ Measurement of deflection angle.

- ☐ Measurement of vertical Angle.
- ☐ Theodolite traversing by Included angle method, Deflection angle method and Magnetic bearing Method.
- ☐ Checks for open and closed traverse.
- ☐ Calculations of Magnetic bearing from angles.
- ☐ Traverse computation-Latitude, Departure, Consecutive coordinates, Independent coordinates, balancing the traverse by Bowditch's rule Transit rule and Third Rule, Gale's Traverse table computation.
- ☐ Errors in Theodolite Surveying- Instrumental, Personal and Natural.
- ☐ Simple numerical problems

Unit– III Tacheometric Surveying and Curve Setting

- ☐ Principles of Tacheometry, Instruments used in Tacheometry, Characteristics of a Tacheometer, Anallatic lens, uses of a Tacheometer.
- ☐ Tacheometric formula for horizontal distance with telescope horizontal and staff vertical.
- ☐ Field method for determining constants of tacheometer, determining horizontal and vertical distances with tacheometer by fixed hair method and staff held vertical and nortmal to the line of collimation (both angle of elevation and depression)
- ☐ Limitations of Tacheometry Survey.
- ☐ Types of curves used in roads and railway alignments. Designation of curves, Properties of Simple Circular Curve.
- ☐ Setting simple circular curve by offsets from long chord and Rankine's method of deflection angle.
- ☐ Simple numerical problems.

Unit– IV Advanced Surveying Equipment

- ☐ Principle of Electronic Distance Meter (EDM), Types, its component parts and their Functions, use of EDM.
- ☐ Use of micro optic Theodolite and Electronic Digital Theodolite.
- ☐ Total Station: Features, Basic components, Functional operation, Use, Description and use of Function keys.
- ☐ Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station, Traversing, Profile Survey and Contouring with Total Station.
- ☐ No numerical problems.

Unit– V Remote Sensing, GPS and GIS

- ☐ Remote Sensing: Overview, Principles, Components, Process, Types of Remote sensing system, sensors used in practice mainly in India, Applications of remote sensing in Civil engineering: land use / Land cover, mapping, disaster management, .
- ☐ Global Positioning System (G.P.S.): Definition, Overview, Function, Principle, Application.
- ☐ Introduction to Differential Global Positioning System (D.G.P.S)
- ☐ Geographic Information System (GIS): Definition, Overview, Components, Applications, Software for GIS.
- ☐ Introduction to Drone Surveying.
- ☐ No numerical problems.

Suggested learning resources:

1. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling Part I and II, Pune Vidyarthi Gruh Prakashan, Pune.
2. Basak, N. N.,Surveying and Levelling, McGraw Hill Education (India) Pvt. Ltd.,Noida.
3. Duggal, S. K., Survey I and Survey II, Tata McGraw Hill Education Pvt. Ltd., Noida.
4. Saikia, M D.; Das. B.M.; Das. M.M., Surveying PHI Learning Pvt. Ltd., New Delhi.
5. Subramanian, R., Surveying and Levelling, Oxford University Press. New Delhi.
6. Punmia, B.C, Jain, Ashok Kumar; Jain, Arun Kumar, Surveying Vol. I and Surveying Vol. II, Laxmi Publications Pvt. Ltd., New Delhi.

7. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning Pvt. Ltd., New Delhi.
8. Venkatramaiah, C, Textbook of Surveying, Universities Press, Hyderabad.
9. Anderson, James M and Mikhail, Edward M, Surveying theory and practice, Mc Graw Hill Education, Noida.
10. Aloke De, Plane Surveying, S.Chand Publications, New Delhi.
11. C.L. Kochher, Surveying, Dhanpat Rai Publication, New Delhi.
12. Dr. N.R. Chandak and Prof. H.R. Kumavat,Surveying, SK Kataria & Sons, New Delhi
13. Saurabh Kumar Soni, Surveying-II, SK Kataria & Sons, New Delhi

Course outcomes: After completing this course, student will be able to:

- ☐ Use digital Planimeter to calculate the areas
- ☐ Prepare plans using Theodolite surveys.
- ☐ Find distances and elevations using Tacheometer.
- ☐ Prepare plans using Total Station instrument.
- ☐ Locate coordinates of stations using GPS.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Theory of Structure and Mechanism	Course Code	CoAPC403
Subject offered in Semester	Fourth	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Objective: - Following are the objectives of this course:

- ☐ To understand the concept of buckling loads for short and long columns.
- ☐ To learn concept of eccentric loading and stresses in vertical members like column, chimneys, dam.
- ☐ To understand the basic concepts of mechanisms.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I and II
Module B/Group B	Unit III
Module C/Group C	Unit IV

Contents:

Unit– I Column

Concept of compression member, short and long column, Effective length, Radius of gyration, Slenderness ratio, Types of end condition for columns, Buckling of axially loaded columns.

- ☐ Euler's theory, assumptions made in Euler's theory and its limitations, Application of Euler's equation to calculate

buckling load.

- ☐ Rankine's formula and its application to calculate crippling load.
- ☐ Concept of working load/safe load, design load and factor of safety.
- ☐ Simple numerical problems.

Unit – II Direct and Bending Stresses in vertical members

- ☐ Introduction to axial and eccentric loads, concept of combined stress, eccentricity about one principal axis only, nature of stresses, Maximum and minimum stresses, resultant stresses distribution diagram.
- ☐ Condition for no tension or zero stress at extreme fiber, Limit of eccentricity, core of section for rectangular and circular cross sections, Middle third rule (without derivation).
- ☐ Chimneys of circular cross section subjected to wind pressure, Maximum and minimum stresses, resultant stresses distribution diagram at base.
- ☐ Analysis of dams subjected to horizontal water pressure, conditions of stability, Maximum and minimum stresses (Principal stresses excluded), resultant stresses distribution diagram at base.
- ☐ Simple numerical problems.

Unit – III Slope and Deflection

- ☐ Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation).
- ☐ Moment Area method to find slope and deflection of cantilever and simply supported beams subjected to concentrated load and uniformly distributed load on entire span/ partial span.
- ☐ Simple numerical problems.

Unit–IV Mechanisms

- Introduction to mechanisms.
- Basic concepts on physical principles, inclined plane, pulley systems, screw type jack, levers and mechanisms, linkages, gears and gearing, pulley and belts, sprockets and chains, cam mechanisms, specialized mechanisms.
- Introduction to industrial robots, mobile robots – scientific, military, research.
- Simple numerical problems.

Suggested learning resources:

1. Ramamrutham.S, Theory of structures, Dhanpatrai & Sons.
2. Khurmi, R. S. , Theory of Structures S. Chand and Co., New Delhi.
3. Bhavikatti, S S , Structural Analysis Vol-1, Vikas Publishing House Pvt Ltd.New Delhi.
4. Junnarkar, S. B., Mechanics of structures, Volume-I and II Charotar Publishing House, Anand.
5. Pandit, G.S. and Gupta, S.P., Theory of Structures Vol I & II, Tata McGraw Hill, New Delhi.
6. Agor R, Structural Analysis, Khanna Publishing House, Delhi.
7. Vazirani and Ratwani, Part I & Part II, Khanna Publishing House, Delhi.
8. Dr. Punmia, B.C, Jain A. K., Theory of Structure, Laxmi Publication
9. Neil Sclater and Nicholas P. Chironis, Mechanisms and Mechanical Devices Sourcebook, McGraw-Hill.

Course outcomes: After completing this course, student will be able to:

- ☐ Analyze the column for various loading and end conditions.

- ☐ Analyze stresses induced in vertical member subjected to direct and eccentric loads/transverse loads.
- ☐ Identify and understand the mechanisms at industrial level.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Geotechnical Engineering	Course Code	CoAPC404
Subject offered in Semester	Fourth	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Following are the objectives of this course:

- ☐ To understand and determine physical and index properties and classification of soil
- ☐ To estimate permeability and shear strength of soil
- ☐ To know the load bearing capacity of soil
- ☐ To learn various soil stabilization and compaction, consolidation, soil exploration methods

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I and II
Module B/Group B	Unit III and IV
Module C /Group C	Unit V

Course Content:

Unit – I: Overview of Geology and Geotechnical Engineering

- ☐ Introduction, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks.
- ☐ Importance of soil as construction material and as supporting medium for structures.
- ☐ Field application of geotechnical engineering: for foundation design, pavement design, design of earth retaining structures, design of earthen dam.

Unit– II: Physical and Index Properties of Soil

- ☐ Soil as a three phase system, water content, purpose and determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index, Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight and their interrelationship, purpose and determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer.
- ☐ Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index, liquidity index, consistency index and toughness index and their significance.
- ☐ Particle size distribution test and plotting of curve, uniformity coefficient and coefficient of curvature, Determination of effective diameter of soil, well graded and uniformly graded soils
- ☐ Importance of soil classification system, BIS classification of soil.

- Simple numerical problems

Unit– III Permeability and Shear Strength of Soil

- Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head tests, simple problems to determine coefficient of permeability.
- Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, equipotential lines, characteristics and application of flow net (No numerical problems).
- Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. laboratory methods on determination of shear strength parameters -Direct shear, triaxial, unconfined compression test and vane shear test [conception only] – their application and significance, unconfined compressive strength
- Simple numerical problems.

Unit– IV Bearing Capacity of Soil and Earth Pressure

- Bearing capacity of shallow foundation, Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity, determination of bearing capacity as per BIS.
- Field methods for determination of bearing capacity – Plate load Test and Standard Penetration Test. Test procedures as per IS:1888 & IS:2131.
- Introduction to deep foundation – pile foundation, caisson and well foundation. Determination of bearing capacity of pile foundation – dynamic formula (Engineering News formula and modified Hilley's formula) and static formula – only formula (no numerical problem based on static formula), simple numerical problems based on dynamic formula only, negative skin friction on piles, group action of piles.
- Definition of earth pressure, Active and Passive earth pressure for horizontal backfill (no inclination) including surcharge on moist soil only, coefficient of earth pressure, Rankine's theory and assumptions, extension of earth pressure theory to cohesive soil only for horizontal backfill including surcharge on moist soil [ground water table is well below the foundation level]
- Simple numerical problems.

Unit– V Compaction, consolidation, stabilization and exploration of soil

- Concept of compaction and its importance, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content (OMC), maximum dry density (MDD), Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. Suitability of various compaction equipment- smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer and Vibrator, Difference between compaction and consolidation.
- Preliminary concept on one dimensional consolidation and consolidation settlement (simple numerical problems on compaction but no numerical problems on consolidation settlement).
- Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization.
- Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores, sample soil exploration report, Field identification of soil – dry strength test, dilatancy test and toughness test.

Suggested learning resources:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2. Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Moitra, Debashis, Geotechnical Engineering, University Press
4. Ramamurthy, T.N. & Sitharam,T.G., Geotechnical Engineering(Soil Mechanics), S Chand and Company LTD., New Delhi.
5. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
6. Kasamalkar, B. J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
7. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.
8. A.K.Upadhyay, Soil and Foundation Engineering, S.K.Kataria & Sons

Course outcomes: After completing this course, student will be able to:

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret soil bearing capacity and earth pressure results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests and settlement due to one dimensional consolidation

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Design of RCC Structure	Course Code	CoAPC405
Subject offered in Semester	Fourth	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites		Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Objective:-

Students will be able to:

1. Analyze the section by LSM.
2. Select Proper materials and Calculate the design values for the materials.
3. Calculate the loads on structural components as per IS 875 (Part-I &II) provisions.
4. Read and interpret structural drawing.
5. Understand the basic principles of design of R.C.C. sections.
6. Use & Correlate the specifications of IS 456-2000: code& SP-16.
7. Draw and appreciate the proper reinforcement detailing of R.C. structural member and their connection using SP-34 & IS 13920.
8. Prepare the detailed drawing of structural elements with key plans and schedule of reinforcement
9. Design singly reinforced, doubly reinforced beams, simply supported beams one way & two-way slabs, axially loaded columns & footings by LSM.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I, II, III and IV
Module B/Group B	Unit V, VI and VII
Module C /Group C	Unit VIII and IX

Unit1: Introduction

1.1 Aim of design, Concept of R.C.C., Necessity of steel as reinforcement and its position in a Simply Supported and continuous member.

1.2 Design- Functional Design & Structural Design.

Scope of a Structural Designer- Structural Planning, Calculation of loads, Analysis, Design & Detailing, Advantages of symmetrical planning over un-symmetrical planning

Loads: Dead load, imposed load, wind loads & other loads as per IS 875(Part-I to Part III) Earthquake forces. – IS 1893- 2002(Part -1), Seismic zones, Combination of loads.

1.3 Methods of design-working stress method, limit state method – Introduction of IS 456 and SP-16

1.4 Detailing- introduction of SP-34 & IS13920Necessity of IS 13920-1993

Unit2: Working stress method

2.1 Introduction

2.2 R.C. Sections, their behavior, Grades of concrete & steel, permissible stresses,

2.3 Assumptions in W.S.M.

2.4 Equivalent bending stress distribution diagram & Moment of Resistance for singly reinforced rectangular section – balanced, under-reinforced & over-reinforced sections – numerical problems

Unit3: Limit State Method

3.1 Definition, types of limit states, partial safety factors for materials strength, characteristic strength

, characteristic load, design load. Loading on structure as per I.S 875.

3.2 I.S. Specification regarding spacing of reinforcement in slab, cover to reinforcement in slab, beam column &footing, minimum reinforcement in slab, beam &column, lapping, anchoring effective span for beam, & slab.

Unit4: Analysis and Design of Singly Reinforced Sections (LSM)

4.1 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.

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

4.3 Simple numerical problems on determining design constants, moment of resistance and area of steel.

Unit5: Analysis and Design of Doubly Reinforced Sections (LSM)

5.1 General features, necessity of providing doubly reinforced Section, reinforcement limitations.

5.2 Analysis of doubly reinforced section, strain diagram, stress diagram, depth of neutral axis, moment of resistance of the section.

5.3 Simple numerical problems on finding moment of resistance and design of beam sections.

Unit6: Shear, Bond and Development Length (LSM)

6.1 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.

6.2 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 Standard Lapping of bars, check for development length.

6.3 Simple 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; Determination of Development length required for tension reinforcement of cantilevers beam and slab, check for development length.

Unit7: Design of lintel

8.1 Design of lintel for flexure under triangular load only for brick work above it and for its self-weight – typical problem solution.

8.2 Design of shear reinforcement for lintel – typical problem solution.

Unit8: Design of Slab (LSM)

9.1 Design of simply supported one-way slabs for flexure check for deflection control, and shear.

9.2 Design of two-way simply supported slabs for flexure with corner free to lift.

9.3 Simple numerical problems on design of one-way simply supported slab & two-way simply supported slab

Unit9: Design of Axially Loaded Column and Footing (LSM)

10.1 Assumptions in limit state of collapse – compression

10.2 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.

10.3 Analysis and design of axially loaded short, square and rectangular columns with lateral ties only; check for short column and check for minimum eccentricity may be applied.

10.4 Types of footing, Design of isolated square footing for flexure, and shear.

10.5 Simple numerical problems on the design of axially loaded short columns and isolated square footing. (Problems on design of footing shall be asked in written examination for moment and two-way shear only.)

I.S. Codes:

1. IS 456:2000 - Plain and Reinforced concrete code of Practice.
2. SP16- Design Aids for reinforced concrete to IS 456.
3. I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures. Part 1 - Dead load

Part 2 - Imposed (live) load Part 3 - Wind load

4. SP 24 - Explanatory Handbook on IS 456
5. IS 1343-1980 - Indian Standard code of (Reaffirmed 1990) Practice for Prestressed concrete.
6. SP34 : 1987 - Handbook on concrete reinforcement and Detailing.
7. IS 13920-1993 DUCTILE detailing of R. C. Building subjected to Scrims forces.

Name of Authors	Titles of the Book	Edition	Name of the Publisher
N. Subramanian	Design of Reinforced Concrete Structure		Oxford University Press
Pillai and Menon	Design of RCC structure		Tata-Mcgrawhill
Sayal and Goyel	Design of RCC structure		
Punmia Jain Jain	Reinforced Concrete		
Verghese	Limit State method of RCC design Vol I & II		
A.K.Jain	Limit State method of design		
Nilam Sharma	Design of RCC structure		

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Safety in Construction	Course Code	CoAPC406
Subject offered in Semester	Fourth	Number of Credits	2 (L:2, T: 0, P: 0)
Prerequisites	NIL	Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives:

- To know the basic terminology of safety, rules and regulations
- To understand the accident patterns and associated theories
- To analyze the hazards and penalty
- To investigate the accidents
- To learn to handle the equipment safely.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I to III
Module B/Group B	Unit IV to VI
Module C /Group C	Unit VII to VIII

Course Content:

Unit 1: Basic terminology in safety, types of injuries, safety pyramid

Unit 2: Accident patterns, theories of accident-causation

Unit 3: Planning for safety budget, safety culture

Unit 4: Introduction to OSHA regulations; Role of stakeholders in safety

Unit 5: Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty

Unit 6: Safety during construction, alteration, demolition works – Earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding

Unit 7: SoPs (Safe Operating Procedures) – Construction equipment, materials handling-disposal & hand tools

Unit 8: Other hazards – fire, confined spaces, electrical safety; BIM & safety

Books and references

1. Hinze, J.W. (1997) Construction Safety, Prentice Hall

2. MacCollum, D.V. (1995) Construction SafetyPlanning, John Wiley & Sons

3. Reese, C.D. & Eidson, J.V. (2006) Handbook ofOSHA Construction Safety and Health, Taylor & Francis.

4. Lingard, H. & Rowlinson, S. (2005) Occupationalhealth and Safety in Construction Project Management, Spon Press.

5. Holt, A.S.J. (2005) Principles of Construction Safety,Wiley-Blackwell Publishers

6. MacCollum, D.V. (2007) Construction Safety Engineering Principles, McGraw Hill Publishers

7. Bhattacharjee, S.K. (2011) Safety Management in Construction, Khanna Publishers

8. Li, R.Y.M. & Poon, S.W. (2013) Construction Safety, Springer Publishers

Few IS Codes & journal papers

Course outcomes: After completing this course, student will be able to:

- Follow the rules and regulations related to safety
- Understand the accident patterns
- Analyze the hazards and penalty related to accidents and safety issues
- Investigate the accidents
- Handle the equipment safely in construction sites.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Basic Surveying Field Practices	Course Code	CoAPC407S
Subject offered in Semester	Fourth	Number of Credits	1(L:0, T: 0, P: 2) Note: Basic Surveying Field Practices may also be conducted in 2- 3 weeks field work continuously instead of having 2 practical class per week for the entire semester.
Prerequisites	Basic Knowledge of surveying and levelling	Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Following are the objectives of this course:

☐ To understand types of surveying works required

☐ To know the type of method and equipment to be used for different surveys, namely, chain, compass, plane table surveys and leveling.

☐ To know the use and operational details of various surveying equipment.

☐ To understand the basic method to be followed for indirect contouring

☐ to give layout of a foundation trench of a building

List of Practicals to be performed

☐ Chain & compass traverse survey – a simple closed traverse of minimum five sides enclosing a building or any suitable site: Reconnaissance, preparation of index map, selection of survey station and finalisation of station, taking FB & BB of lines, ranging a line, chaining a line, taking offset with chain and tape, setting out right angles, calculation of included angles, angular error adjustment, closing error and its balancing by Bowditch method, locating details and plotting them on a A1 size imperial drawing Sheet.

☐ Profile and Cross-section Levelling – running a longitudinal section for a length not less than 250 m for a road using dumpy /auto level and levelling staff. At least four cross sections shall be taken suitably. Undertake fly leveling to check the precision of levelling. Plotting alignment (at least one deviation), L- section including profile leveling and Cross section on an A1 size imperial sheet. all the data will be booked in standard level book. Arithmetical check will have to be performed each and every page.

☐ Block contouring – a block of suitable area with spot levels at suitable interval will be chosen for plotting the contours by indirect method on A-1 size imperial drawing sheet with a contour interval suitable for the site.

☐ Measure area of irregular figure using formula (Simpson/ trapezoidal), Graph paper and Digital planimeter.

☐ Plane table surveying – demonstration of accessories and their function; centering, levelling and orientation of plane table; traversing by plane table; plane table surveying around a building or a small

area of closed traverse of minimum four sides suitably including filling in details by radiation, intersection and traversing method on A1 size imperial drawing sheet.

- ☐ Layout of a building: Layout of a building for a given problem (building of any type consisting of a frame structure or load bearing walls system or composite structure). Plotting the Layout Plan of the building on A-1 size imperial drawing sheet.

Suggested learning resources:

1. Punmia, B.C, Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P., Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D, Das. B.M., Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.
7. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R, Surveying Vol. I, Standard Book House.
10. C.L. Kochher, Surveying, Dhanpat Rai Publication, New Delhi.
11. Dr. N.R. Chandak and Prof. H.R. Kumavat, Surveying, SK Kataria & Sons, New Delhi
12. Saurabh Kumar Soni, Surveying-I, SK Kataria & Sons, New Delhi
13. Agor, R., A Text Book of Surveying & Levelling, Khanna Publishers.
14. Chandra A.M., Plane Surveying, New Age International Publishers

Course outcomes: *After completing this course, student will be able to:*

- ☐ Select the type of survey required for given situation.
- ☐ Conduct traversing in the field using chain & compass and plane table.
- ☐ Use levelling instruments to determine reduced level to prepare contour maps and profile levelling and cross section details
- ☐ Use digital planimeter to calculate the areas.
- ☐ Perform layout of a foundation trench

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Estimating & Costing	Course Code	CoAPC408S
Subject offered in Semester	Fourth	Number of Credits	1(L:0, T: 0, P: 2)
Prerequisites	Student should know accounting process, mensuration and drawing.	Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Students should be able to

1. Decide approximate cost of civil engineering structure.
2. Prepare check list of items of construction.
3. Prepare estimate for civil engineering work.

4. Prepare rate analysis of item of construction.

5. Take measurement of completed work.

6. Compare actual quantity with estimated quantity

Unit -1 Overview of Estimating & Costing

1.1 Meaning of the terms estimating, costing. Purpose of estimating and costing, factors affecting estimate

1.2 Types of estimate - Approximate and Detailed. Approximate estimate Types- Plinth area rate method, Cubic Content method, Service Unit method, Typical bay method, Approximate Quantity method, Problems on Plinth area rate method& application of Service unit method for selection of service unit for different types of civil Engineering Structures, Approximation for W.S. Sanitary & Electrification, Knowledge of empirical method of approximate material estimation as per CBRI formulae and its application

1.3 Types of detailed estimate: Detailed estimate for new work, Revised estimate, Supplementary estimate, Revised & Supplementary estimate, Maintenance & Repair estimate, complete estimate; phase of the detailed estimate – quantity survey and abstract estimate, Uses of detailed estimate

1.4 Explanation of relevant technical terms: Contingencies, work-charge establishment, overhead, tools and plants, schedule of rates and quantities, specification, administrative approval, technical sanction, plinth area, carpet area, floor area, horizontal and vertical circulation area, floor area ratio

1.5 Degree of accuracy, mode of measurement as per BIS 1200

Unit 2: Building estimate

Note: single storeyed building shall comprise of two rooms, bath, WC, kitchen, front verandah with a provision of staircase and mumty for utilization of roof space

2.1 Centre line method and long & short wall method

2.2 Items of work –earth work in excavation for foundation, brick flat soling(under foundation and floor subgrade, foundation concrete, brick in substructure, earth work in filling, DPC, plinth filling by silver sand, brickwork in superstructure, formwork, RCC excluding reinforcement, reinforcement (by percentage of component of structure, lime terracing or other similar roof treatment, finishing items – plastering, painting (on plastered surface wall, RCC surface, doors windows, grill etc), floor – (IPS, terrazzo, tiles, stone), rain water pipe,

2.3 Preparation of bar bending schedule – lintel and chajja, column, slab (one way and two way), beam and their estimate

2.4 Estimate of door and window – panelled door, one third glazed and two-third panelled timber window, fully glazed steel window provided with a grill (inclusive of all fittings and fixtures)

2.5 estimate of a tube-well

2.6 estimate of a septic tank with soakpit

2.7 Estimate for surface drain with plinth protection around the building and underground reservoir

2.8 Estimation of symmetrical/unsymmetrical boundary wall with a provision of gate.

Unit 3 Estimate of other structure

3.1 Estimate of a single span slab culvert/pipe culvert

3.2 estimate of a man-hole

3.3 Estimate of simple fink type roof truss

Unit – 4 Rate analysis

4.1 Meaning of term Rate analysis and its purposes –Factors affecting rate analysis, lead, lift, task work, materials and labour component, Market Rate and labour rate.

4.2 Transportation of Materials, load factor for different materials. Standard lead, extra lead, Transportation Charges, Labour - Categories of labours, labour rates, overheads, contractor's profit, water charges, taking out quantities of materials for different items of works (earthwork, brickwork, flooring, roofing, plastering and pointing, whitewash, colour wash, distemper, synthetic enamel, plastic paints, emulsion paint, cement concrete, reinforcement, formwork, grill for window

4.3 Preparing rate analysis of different items of work - (earthwork, brickwork, flooring, roofing, plastering and

pointing, whitewash, colour wash, distemper, synthetic enamel, plastic paints, emulsion paint, cement concrete, reinforcement, formwork, grill for window

Assignments:

Skills to be developed:

Intellectual Skills:

a. List various items of work with their units in a Civil Engineering Structure.

b. Calculate quantities of various items of work.

c. Prepare rate analysis.

List of Assignments: *(Drawings shall be provided for the above exercises by subject teacher.)*

1. The entire job as per syllabus are to be submitted in the form of assignments.

Text Books: -

Name of Authors	Titles of the Book	Edition	Name of the Publisher
M. Chakraborti	Estimating & costing, Specification and Valuation in Civil Engineering		M. Chakraborti , Calcutta
B.N. Datta	Estimating & costing in Civil engineering		UBS Publishers
S.C. Rangwala	Estimating & costing		Charotar Publication
B.S. Patil	Civil Engineering Contracts and Accounts Vol I , II		Orient Longman
G. S. Birdie	ESTIMATING & COSTING		Dhanpat Rai and Sons

Video cassettes / cds: msbtecai package

Q. E. PRO software

IS CODES: IS 1200- Method of Measurement of building and Civil engineering work

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Construction Automation Lab- II Module-V: Geotechnical Engineering Lab	Course Code	CoAPC409S/I
Subject offered in Semester	Fourth	Number of Credits	1(L:0, T: 0, P: 2)
Prerequisite s	Basic Knowledge in Geotechnical Engineering	Course Category	PC
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Following are the objectives of this course:

- To understand and determine physical and index properties of soil.
- To estimate the permeability and shear strength of soil.
- To know the procedure for performing C.B.R test.
- To learn various compaction methods for soil stabilization.

List of Practical to be performed: [Number of experiments should be performed as much as practicable in commensurate with availableresourcesandfacilities–atleast six experiments]

1. Identification of rocks from the given specimen.
2. Determine water content of given soil sample by oven drying method as per IS: 2720 (Part- II).
3. Determine specific gravity of soil by Pycnometer method as per IS 2720 (Part- III).
4. Determine dry unit weight of soil in field by core cutter method as per IS 2720 (Part- XXIX).
5. Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part- XXVIII).
6. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS 2720 (Part- V).
7. Use different types of soil to identify and classify soil by conducting field tests- Through Visual inspection, Dry strength test, Dilatancy test and Toughness test.
8. Determine coefficient of permeability by constant head test/ by falling head test as per IS 2720 (Part- XVII).
9. Determine shear strength of soil by direct shear test as per IS 2720 (Part-XIII).
10. Determine MDD and OMC by standard Proctor test of given soil sample as per IS 2720 (Part- VII).
11. Determination of CBR value on the field as per IS2720 (Part - XVI).

Suggested learning resources:

1. Reddy E Saibaba & Sastry K.Rama – Mesurement of Engineering Propertiesof soil, Newage International Publishers
2. K V S Apparoa & V C S Rao, Soil Testing, Laxmi Publication Pvt Ltd
3. S. Mittal & J P Shukla, Soil testing for Engineers, Khanna Publishers
4. Dr. D.K.Maharaj, Laboratory Manual for soil testing, S.K. Kataria & Sons.

Course outcomes: *After completing this course, student will be able to:*

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret the soil bearing capacity results.
- Compute optimum moisture content values for maximum dry density of soil through various tests.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Program Elective - I: Precast and Prestressed Concrete	Course Code	CoAPE 409/I
Subject offered in Semester	Fourth	Number of Credits	3(L:3, T: 0, P: 0)
Prerequisites		Course Category	PE
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Following are the objectives of this course:

- ☐ To introduce various types of precast and prefabricated concrete elements.
- ☐ To know advantages and disadvantages of precast and prefabricated concrete elements.
- ☐ To understand prestressing methods, systems for Reinforced Concrete members.
- ☐ To learn issues involved in design of prestressing system and loss of prestressing.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I and II
Module B/Group B	Unit III and IV
Module C /Group C	Unit V

Course Content:

Unit – I Precast concrete Elements

- ☐ Advantages and disadvantages of precast concrete members
- ☐ Non-structural Precast elements- Paver blocks, Fencing Poles, Transmission Poles, Manhole Covers, Hollow and Solid Blocks, kerb stones as per relevant BIS specifications (Overall Idea excluding detail dimensions)
- ☐ Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles (Overview without detail design)
- ☐ Testing of Precast components as per BIS standards

Unit– II Prefabricated building

- ☐ Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, stair case elements,
- ☐ Prefabricated building using precast load bearing and non-load bearing wall panels, floor systems - Material characteristics, Plans & Standard specifications
- ☐ Modular co-ordination, modular grid, and finishes
- ☐ Prefab systems and structural schemes and their classification including design considerations
- ☐ Joints – requirements of structural joints and their design considerations
- ☐ Testing of Precast components as per BIS standards
- ☐ Manufacturing, storage, curing, transportation and erection of above elements, equipment needed

Unit– III Introduction to Prestressed Concrete

- ☐ Principles of pre-stressed concrete and basic terminology.
- ☐ Applications, advantages and disadvantages of pre-stressed concrete
- ☐ Materials used and their properties, Necessity of high-grade materials
- ☐ Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits and applications

Unit– IV Methods and systems of prestressing

- ☐ Methods of prestressing – Internal and External pre-stressing, Pre and Post tensioning applications
- ☐ Systems for pre-tensioning – process, applications, merits and demerits – Hoyer system
- ☐ Systems for post-tensioning - process, applications, merits and demerits - Freyssinet sys- tem, Magnel Blaton system, Gifford Udall system.
- ☐ Prestressing force in Cable, Loss of prestress during the tensioning process - loss due to friction, length effect, wobbling effect and curvature effect, (Simple Numerical problems to determine loss of prestress), Loss of prestress at the anchoring stage.
- ☐ Loss of pre-stress occurring subsequently: losses due to shrinkage of concrete, creep of concrete, elastic shortening, and creep in steel, (Simple Numerical problems to determine loss of prestress).
- ☐ BIS recommendations for losses in case of Pre and Post tensioning.

Unit– V Analysis and design of Prestressed rectangular beam section

- ☐ Basic assumptions in analysis of pre-stressed concrete beams.
- ☐ Cable Profile in simply supported rectangular beam section – concentric, eccentric- straight and parabolic
- ☐ Effect of cable profile on maximum stresses at mid span and at support.
- ☐ Numerical problems on determination of maximum stresses at mid spans with linear (con- centric and eccentric) cable profiles only.
- ☐ Simple steps involved in Design of simply supported rectangular beam section (No numerical problems)

Suggested learning resources

- ☐ Krishna Raju, N., Pre-stressed Concrete, Tata McGraw Hill, NewDelhi.
- ☐ Nagarajan, Praveen., Pre-stressed Concrete Structures, Pearson EducationIndia
- ☐ Shrikant B. Vanakudre, Prestressed Concrete, Khanna Publishing House, NewDelhi
- ☐ Nor Ashikin, Marzuki, PreCast and PreStress Technology: Process, Method and Future Technology, Createspace Independent Publication.
- ☐ Lin, T.Y., Design of Pre-Stressed Concrete Structures, John Wiley and Sons, New York BIS, New Delhi. IS 1343 Prestressed Concrete – Code of Practice, BIS, New Delhi
- ☐ Indian Concrete Institute., Handbook on Precast Concrete buildings.
- ☐ Elliott, Kim S., Precast Concrete Structures, CRC Press, NewYork.
- ☐ BIS, New Delhi. IS 12592 Precast Concrete Manhole Cover and Frame, BIS, New D e l h i
- ☐ BIS, New Delhi. IS 15658 Precast concrete blocks for paving- Code of Practice, BIS, New Delhi
- ☐ BIS, New Delhi. IS 15916 Building Design and Erection Using Prefabricated Concrete

- Code of Practice, BIS, New Delhi

- ☐ BIS, New Delhi. IS 15917 Building Design and Erection Using Mixed/Composite Construction
- ☐ - Code of Practice, BIS, New Delhi
- ☐ BIS, New Delhi. IS 458 Precast Concrete Pipes (with and without reinforcement)— Specification, BIS, New Delhi
- ☐ Guide for Precast Concrete Tunnel Segments – ACI 533.5R-20 – American Concrete Institute
- ☐ Guidelines for Lining of Irrigation Canals – Govt. of Odisha – Department of Water Resources
- ☐ Y.R.M Rao, Prestress Concrete analysis and design, S.K.Kataria & Sons

Course outcomes: *After completing this course, student will be able to:*

- ☐ Describe different types of precast concrete elements
- ☐ classify different components of pre-fabricated buildings
- ☐ Describe the basics of prestressed concrete
- ☐ Describe the methods and systems of prestressing
- ☐ Analyze and design of prestressed rectangular beam

Name of the Course	Diploma in Construction Automation	Course duration	6 semester
Course Title	Program Elective - I: Rural Construction Technology	Course Code	CoAPE 409/II
Subject offered in Semester	Fourth	Number of Credits	3(L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	PE
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives: Following are the objectives of this course:

- To learn development and planning of low cost housing infrastructure.
- To know about different government schemes for rural development.
- To understand techniques for rural road construction as per IRC stipulations.
- To learn rural irrigation techniques and watershed management.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I and II
Module B/Group B	Unit III
Module C /Group C	Unit IV and V

Course Contents:

Unit I - Rural Development and Planning

- Scope; development plans; various approaches to rural development planning.
- Significance of rural development.
- Rural development programme/projects.

Unit II -Rural Housing

- Low cost construction material for housing
- Composite material- ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls.

- Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rattrap bond for walls; Panels for roof, ferro-cement flooring/roofing units.
- Biomass - types of fuels such as firewood, agricultural residues, dung cakes.
- Renewable energy and integrated rural energy program - Objectives, Key elements, Implementation, Financial provisions, sources of renewable energy.
- Working of gobar gas and bio gas plants.

Unit III Water Supply and Sanitation for Rural Areas

- Sources of water: BIS & WHO water standards.
- Quality, Storage and distribution for rural water supply works.
- Hand pumps-types, installation, operation, and maintenance of hand pumps.
- Conservation of water - rainwater harvesting, drainage in rural areas.
- Construction of low cost latrines: Two pit pour flush water seal, septic tank etc.
- Low cost community and individual Garbage disposal systems, Ferro-cement storage tanks

Unit IV - Low Cost Rural Roads

- Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases.
- Guidelines for Surfacing of Rural Road as per relevant IRC codes.
- Pradhan Mantri Gram Sadak Yojna (PMGSY)- Highlights of Scheme.

Unit V - Low Cost Irrigation

- Design consideration and construction of tube-well, drip & sprinkler irrigation systems.
- Watershed and catchment area development –problems and features of watershed management.
- Watershed management structures - Gabian Structure, Cement Plug, Contour, Bunding, Farm pond, Bandhara system.

Suggested learning resources:

1. Madhov Rao A G, and Ramachandra Murthy, D S, Appropriate Technologies for low cost Housing Oxford and IBH Publishing Co. Pvt. Ltd.
2. CBRI, Roorkee, Advances in Building Materials and Constriction.
3. Desai,Vasant , Rural Development in India: Past, Present and Future : a Challenge in the Crisis, Himalaya Publishing House, Delhi.
4. Rastogi, A.K. Rural Development Strategy, Wide Vision, Jaipur.
5. Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications India Pvt Ltd.
6. Gaur, Keshav Dev, Dynamics of Rural Development, Mittal Publications, Delhi.
7. Document Published by Ministry of Rural development, Govt. of India, Ministry of Rural development.

Course outcomes: After completing this course, student will be able to:

- Plan low cost housing using rural materials.
- Make use of relevant government schemes for construction of roads and housing.
- Use guidelines for rural road construction.
- Implement different irrigation systems for rural areas.
- Identify the need of watershed management in rural areas.

Name of the Course	Diploma in Construction Automation	Course duration	6 semesters
Course Title	Minor Project	Course Code	CoAPR411S
Subject offered in Semester	Fourth	Number of Credits	2 (L:0, T: 0, P: 4)
Prerequisites	Students should have knowledge of Surveying, Building planning drawing and CAD	Course Category	PR
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Objective:- Following are the objectives of this course:

- ☐ To collect the information for a given project.
- ☐ To apply principles, theorems and bye-laws in the project planning.
- ☐ To interpret and analyze the data.
- ☐ To develop professional abilities such as persuasion, confidence, and perseverance and communication skill.
- ☐ To develop presentation skill.
- ☐ To enhance creative thinking.

[The project report shall be in the following format:

(The project shall be undertaken by a group of students as per convenience) Topic and objectives

Collection of data, required survey work, Required drawing set

Utility to society if any Conclusion]

Contents:-

Title of the Project:-Planning of (G+2) Residential Complex for Middle Income Group(as per SP-7and rules and regulation of local bodies) for sanction before Project approval committee.

NOTE: Same Planning, Drawings and detailing of the problem given in this semester will have to be used in Major Project I and Major Project II in semester 5 and 6.

The details of the Project are given below:-

Each building (RCC framed structure) shall comprise of two symmetrical flat per floor each containing two rooms, bath, WC, kitchen, front verandah with a provision of common staircase and mumty for utilization of roof space and overhead water tank (on 10000 sq m. of total land area). Ground floor to be used for parking spaces.

The following provisions are to be considered during the project planning:- a) Security room(Single room with WC, Load bearing wall structure), b) Central Park, c) Play Ground, d) Hume Pipe Culvert in between the complex and the 12m wide main road, e) Boundary Wall with main gate, f) Submersible Pump, g) Pump House (Load bearing wall structure), h) Surface Drainage System, i) Bituminous road over WBM inside the complex etc.

1) The project report shall include Topographical surveying map, Architecture planning, preparation of drawing sheet –Key Plan, Site plan, a typical floor plan, roof plan with provision of drainage, sectional elevation including staircase, front view, preparation of Rough cost estimate of the project, calculation of FAR, Specification of different item of works and Cost of Land.

2) The project report shall also comprise of drawing sheets of the following-

Floor plan and front elevation of Security Room & Pump house, Plan and sectional elevation of Hume pipe culvert, Plan

and front elevation of Boundary Wall with main gate, Sectional elevation of Bituminous road over WBM.

[NOTE: In addition to conventional approach to Civil Engineering Drawing, student may also take the help of CAD in preparing their sessional works if he/she desires so.]

Course outcomes: After completing this course, student will be able to:

- List the different data for the project after surveying the plot.
- Apply the principles, rules, regulations & by-laws of project planning.
- Utilise the collected data for arranging different building units in a vacant land.
- Prepare the drawing and detailing of the project by using various drafting softwares.
- Solve the problem by working in a group.
- Improve creative thinking about planning of a housing complex.