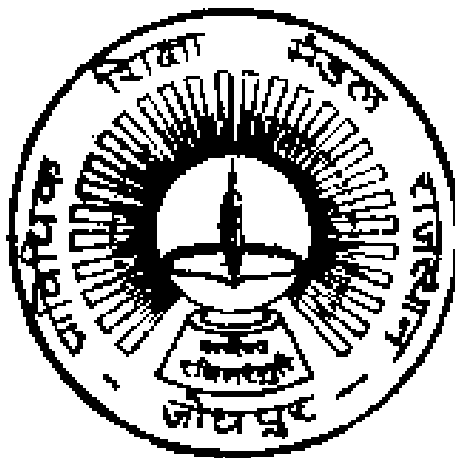


GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN
JODHPUR

SEMESTER SCHEME-2020-21

(SESSION 2021-2022 & ONWARDS)



TEACHING AND EXAMINATION SCHEME
AND SYLLABUS

CIVIL ENGINEERING

(CE)

.....
Curriculum Development Cell
Board of Technical Education, Rajasthan
W-6 Residency Road,
Jodhpur

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA III SEMESTER (CIVIL ENGINEERING) (CE)
SESSION 2021-2022 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration						Total Marks	Credits	
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Ass i			PR(S)
PC	*CE 3001	Construction Material	3	--	--	3	60	3	--	--	20	20	--	100	3
PC	*CE 3002	Basic Surveying	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	**CE 3003	Mechanics of materials	3	--	--	3	60	3	--	--	20	20	--	100	3
PC	*CE 3004	Building Construction	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	**CE 3005	Concrete Technology	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	**CE 3006	Geotechnical Engineering	3	--	--	3	60	3	--	--	20	20	--	100	3
PC	*CE 3007	Construction Material Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	*CE 3008	Basic Surveying Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	**CE 3009	Mechanics of Materials Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	**CE 3010	Concrete Technology Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	**CE 3011	Geotechnical Engineering Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
SI	CE 3012	Summer Internship – I (4 weeks after II Sem.)	--	--	--	--	--	--	100	--	--	--	--	100	2
VS	+CE 3333	Anandam(Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	15	0	14	29	360	--	300	--	120	120	400	1300	24
Grand Total :													1300	24	

- | | |
|--|---|
| 1. L : Lecture | 5. PR : Marks for End Semester Exam for Practical |
| 2. T : Tutorial | 6. CT : Marks for class tests (Internal Assessment) |
| 3. P : Practical | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment) |

1+CE 3333 is same in all branches of Engineering

2.*CE 3001, *CE 3002, *CE 3004, *CE 3007 and *CE 3008, are same as CC 3001, CC 3002, CC 3004, CC 3007, CC 3008, and CC 3011 respectively

3.**CE 3003, **CE 3005, **CE 3006, **CE 3009, **CE 3010 and **CE3011 are same as CC/CV 3003, CC/CV 3005, CC/CV 3006, , CC/CV 3009, CC/CV 3010 and CC/CV 3011 respectively

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA IV SEMESTER (CIVIL ENGINEERING) (CE)
SESSION 2021-2022 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration						Total Marks	Credits	
			Hours per week				End Semester Exam			Internal Assessment					
			L	T	P	Tot	TH	Hrs	PR	Hrs.	CT	TU/Assi			PR(S)
PC	**CE 4001	Hydraulics	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	*CE 4002	Advanced Surveying	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	*CE 4003	Theory of Structure	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	*CE 4004	Building Planning and Drawing	1	--	--	1	60	3	--	--	20	20	--	100	1
PC	^s CE 4005	Water Resource Engineering	2	--	--	2	60	3	--	--	20	20	--	100	2
PC	*CE 4006	Transportation Engineering	2	--	--	2	60	3	--	--	20	20	--	100	2
PE	CE 4007	Programme Elective - I **CE 40071- Construction Management *CE 40072 -Rural Construction Technology	3	--	--	3	60	3	--	--	20	20	--	100	3
PC	**CE 4008	Hydraulics Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	*CE 4009	Advanced Surveying Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	**CE 4010	Building Planning and Drawing Lab	--	--	4	4	--	--	40	3	--	--	60	100	2
PC	CE 4011	Water Resource Engineering Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	*CE 4012	Transportation Engineering Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PR	CE 4013	Minor Project	--	--	4	4	--	--	40	--	--	--	60	100	2
AU	+CE 4222	Essence of Indian Knowledge and Tradition	2	--	--	2	--	--	--	--	--	--	--	--	--
VS	+CE 4444	Anandam(Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	16	--	20	36	420	--	240	--	140	140	460	1400	24
Grand Total :													1400	24	

- | | |
|--|---|
| 1. L : Lecture | 5. PR : Marks for End Semester Exam for Practical |
| 2. T : Tutorial | 6. CT : Marks for class tests (Internal Assessment) |
| 3. P : Practical | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment) |

1. +CE 4222 and +CE 4444 are same in all branches of Engineering.

2. *CE 4002, *CE 4003, *CE 4004, *CE 4006, *CE 40072, *CE 4009, and *CE 4012 are same as CC 4002, CC 4003, CC 4004, CC 4006, CC 40072, CC 4009, and CC 4012 respectively

3. **CE4001, **CE40071, **CE4008 and **CE4010 are same as CC/CV 4001, CC/CV 40071, CC/CV 4008 and CC/CV 4010 respectively

4. ^sCE 4005 is same as CV4005

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Note: Students will go for 6 Weeks Summer Internship in the Summer Vacations after Fourth Semester. The assessment of the Summer Internship will be done in Fifth Semester

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA V SEMESTER (CIVIL ENGINEERING) (CE)
SESSION 2022-2023 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/Assi gn	PR(S)		
PC	*CE 5001	Design of Steel and RCC Structure	4	--	--	4	60	3	--	--	20	20	--	100	4
PC	**CE 5002	Estimating Costing and Valuation	2	--	--	2	60	3	--	--	20	20	--	100	2
OE	+CE 5100	Open Elective-I +CE 51001- Economic Policies in India +CE 51002- Engineering Economics & Accountancy	3	--	--	3	60	3	--	--	20	20	--	100	3
PE	CE 5003	Programme Elective - II CE 50031- Solid Waste Management *CE 50032- Building Services and Maintenance	3	--	--	3	60	3	--	--	20	20	--	100	3
PE	CE 5004	Programme Elective - III §CE 50041- Green Building and Energy Conservation ***CE 50042- Advanced Construction Technology	3	--	--	3	60	3	--	--	20	20	--	100	3
PC	*CE 5005	Design of Steel and RCC Structure Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PC	**CE5006	Estimating Costing and Valuation Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
SI	CE 5007	Summer Internship – II(6 weeks after IV Sem)	--	--	--	--	--	--	100	--	--	--	--	100	3
PR	CE 5008	Major Project	--	--	2	2	--	--	--	--	--	--	--	--	--
VS	+CE 5555	Anandam(Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	15	--	10	25	300		180		100	100	220	900	22
Grand Total :													900	22	

- | | |
|--|---|
| 1. L : Lecture | 5. PR : Marks for End Semester Exam for Practical |
| 2. T : Tutorial | 6. CT : Marks for class tests (Internal Assessment) |
| 3. P : Practical | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment) |

1. +CE 51001, +CE 51002 and +CE 5555 are same in all branches of Engineering
2. *CE 5001, , *CE 50032, *CE 5005 are same as CC 5001, CC 50032 and CC 5005 respectively
3. **CE 5002 and **CE 5006 are same as CC/CV 5002 and CC/CV 5006 respectively
4. §CE 50041 is same as CC/AR/CV 50041
5. ***CE 50042 is same as AR 50042

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Note:Major Project will be continued and Assesed in VI Semester

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA VI SEMESTER (CIVIL ENGINEERING) (CE)
SESSION 2022-2023 & ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs	PR	Hrs	CT	TU/Assi	PR(S)		
HS	+CE 6111	Entrepreneurship and Start-ups	3	1	--	4	60	3	--	--	20	20	--	100	4
OE	+CE 6200	Open Elective-II +CE 62001- Project Management +CE 62002- Renewable Energy Technologies	3	--	--	3	60	3	--	--	20	20	--	100	3
OE	+CE 6300	Open Elective-III +CE 63001- Product Design +CE 63002- Disaster Management	3	--	--	3	60	3	--	--	20	20	--	100	3
AU	+CE 6333	Indian Constitution	2	--	--	2	--	--	--	--	--	--	--	--	--
PC	*CE 6001	Public Health Engineering	3	--	--	3	60	3	--	--	20	20	--	100	3
PE	CE 6002	Programme Elective IV *CE 60021- Repairs and Maintenance of Structures *CE 60022- Tendering and Accounts	3	--	--	3	60	3	--	--	20	20	--	100	3
PC	*CE 6003	Public Health Engineering Lab	--	--	2	2	--	--	40	3	--	--	60	100	1
PR	CE 6004	Major Project	--	--	6	6	--	--	40	--	--	--	60	100	4
SE	CE 6005	Seminar	1	--	--	1	--	--	--	--	--	--	100	100	1
VS	+CE 6666	Anandam (Joy of Giving)	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	18	1	12	31	300	--	80	--	100	100	320	900	24
Grand Total :													900	24	

- | | |
|--|---|
| 1. L : Lecture | 5. PR : Marks for End Semester Exam for Practical |
| 2. T : Tutorial | 6. CT : Marks for class tests (Internal Assessment) |
| 3. P : Practical | 7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment) |
| 4. TH : Marks for End Semester Exam for Theory | 8. PR(S) : Marks for practical and viva (Internal Assessment) |

1. +CE 6111, +CE 62001, +CE 62002, +CE 63001, +CE 63002, +CE 6333 and +CE 6666 are same in all branches of Engineering.

2. *CE 6001, *CE 60021, *CE 60022, and *CE 6003 are same as CC 6001, CC 60021, CC 60022, and CC 6003 respectively

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR
SEMESTER SCHEME-2020-21



III SEMESTER
(SESSION 2021-2022 & ONWARDS)

CONSTRUCTION MATERIAL

Course Code	CE 3001 (Same as CC 3001)
Course Title	Construction Material
Number of Credits	3(L:3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

1. To learn about various construction materials, and understand their relevant characteristics.
2. To be able to identify suitability of various materials for different construction purposes.
3. To know about natural, artificial, and processed materials available for various purposes of construction activities.

Course outcomes:

After competing this course, student will be able to:

1. Identify relevant construction materials.
2. Identify relevant natural construction materials.
3. Select relevant artificial construction materials.
4. Select relevant special type of construction materials.

Identify and use of processed construction materials.

Course Content:**1. Overview of Construction Materials**

- 1.1 Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (applications only).
- 1.2 Selection of materials for different Civil Engineering structures on the basis of strength, durability, eco-friendly and economy.
- 1.3 Broad classification of materials – Natural, Artificial, special, finishing and recycled.

2. Natural Construction Materials**2.1 Stones**

- 2.1.1 Requirements of good building stone
- 2.1.2 General characteristics of stone
- 2.1.3 Quarrying and dressing methods and tools for stone

2.2 Timber

- 2.2.1 Structure of timber
- 2.2.2 General properties and uses of good timber
- 2.2.3 Different methods of seasoning for preservation of timber
- 2.2.4 Defects in timber
- 2.2.5 Use of bamboo in construction

2.3 Asphalt, bitumen and tar used in construction, their properties and uses**2.4 Properties of lime, its types and uses****2.5 Properties of sand and uses****2.6 Classification of coarse aggregate according to size****3. Artificial Construction Materials****3.1 Bricks**

- 3.1.1 Constituents of brick earth
- 3.1.2 Conventional / Traditional bricks
- 3.1.3 Modular and Standard bricks
- 3.1.4 Special bricks – fly ash bricks
- 3.1.5 Characteristics of good brick
- 3.1.6 Field tests on Bricks

- 3.1.7 Classification of burnt clay bricks and their suitability
- 3.1.8 Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks
- 3.2 Flooring tiles – types and uses
- 3.3 Cement
 - 3.3.1 Manufacturing process of Cement - dry and wet (only flow chart)
 - 3.3.2 Types of cement and its uses
 - 3.3.3 Field tests on cement
- 3.4 Precast concrete blocks- hollow, solid, pavement blocks, and their uses
- 3.5 Plywood, Particle board, Veneers, laminated board and their uses
- 3.6 Types of glass: Soda lime glass, lead glass and borosilicate glass and their uses
- 3.7 Ferrous and non-ferrous metals and their uses
- 4. Special Construction Materials**
 - 4.1 Types of material and suitability in construction works of following materials:
 - 4.1.1 Water proofing
 - 4.1.2 Termite proofing
 - 4.1.3 Thermal and sound insulating materials
 - 4.2 Fibers – Types – Jute, Glass, Plastic Asbestos Fibers, (only uses)
- 5. Processed Construction Materials**
 - 5.1 Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses
 - 5.2 Wall Putty
 - 5.3 Paints:
 - 5.3.1 Whitewash
 - 5.3.2 Cement paint
 - 5.3.3 Distempers
 - 5.3.4 Oil Paints and Varnishes with their uses (Situations where used)
 - 5.4 Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses

References:

1. Ghose, D. N., Construction Materials, Tata McGraw Hill, New Delhi.
2. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, Delhi
3. Varghese, P.C. , Building Materials, PHI learning, New Delhi.
4. Rangwala, S.C., Engineering Materials, Charator publisher, Ahmedabad.
5. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
6. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.
7. Sood H., Laboratory Manual on Testing of Engineering Materials, New Age Publishers, New Delhi.
8. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
9. Duggal, S. K., Building Materials, New International, New Delhi.

BASIC SURVEYING

Course Code	CE 3002 (Same as CC 3002)
Course Title	Basic Surveying
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To understand types of surveying works required
- To know the types of method and equipments to be used for different surveys
- To know the use and operational details of various surveying equipments

Course outcomes:

After completing this course, student will be able to:

- Select the type of survey required for given situation
- Compute area of open field using chain, tape and cross staff
- Conduct traversing in the field using chain and compass
- Use levelling instruments to determine reduced level for preparation of contour maps
- Use digital planimeter to calculate the areas

Course Content:**1. Overview and Classification of Survey**

- 1.1 Survey – Principles, purpose and use
- 1.2 Types of surveying: Primary and Secondary
- 1.3 Classification of surveying
 - 1.3.1 Plane
 - 1.3.2 Geodetic
 - 1.3.3 Cadastral
 - 1.3.4 Hydrographic
 - 1.3.5 Photogrammetry
 - 1.3.6 Aerial
- 1.4 Scales
 - 1.4.1 Engineer's scale
 - 1.4.2 Representative Fraction (RF) and
 - 1.4.3 Diagonal scale

2. Chain Surveying

- 2.1 Instruments used in chain survey:
 - 2.1.1 Chains
 - 2.1.2 Tapes
 - 2.1.3 Arrow
 - 2.1.4 Ranging rod
 - 2.1.5 Line ranger
 - 2.1.6 Offset rod
 - 2.1.7 Open cross staff
 - 2.1.8 Optical square
- 2.2 Chain survey Station, Base line, Check line, Tie line, Offset, Tie station
- 2.3 Ranging: Direct and Indirect Ranging
- 2.4 Methods of Chaining, obstacles in chaining.
- 2.5 Errors in length:
 - 2.5.1 Instrumental error
 - 2.5.2 Personal error
 - 2.5.3 Error due to natural cause
 - 2.5.4 Random error
- 2.6 Principles of triangulation
- 2.7 Types of offsets: Perpendicular and Oblique
- 2.8 Conventional Signs, Recording of measurements in a field book

3. Compass Traverse Survey

- 3.1 Compass Traversing- open, closed

3.2 Technical terms:

- 3.2.1 Geographic/ True Magnetic Meridians and Bearings,
- 3.2.2 Whole Circle Bearing system and Reduced Bearing system and examples on conversion of given bearing to another bearing (from one form to another),
- 3.2.3 Fore Bearing and Back Bearing
- 3.2.4 Calculation of internal and external angles from bearings at a station
- 3.2.5 Dip of Magnetic needle
- 3.2.6 Magnetic Declination

3.3 Types of Compass

- 3.3.1 Components of Prismatic Compass and their Functions
- 3.3.2 Introduction of Surveyor Compass

3.4 Methods of using Prismatic Compass- Temporary adjustments and observing bearings (With Numerical)**3.5 Local attraction, Methods of correction of observed bearings - Correction at station and correction to included angles.****3.6 Methods of plotting a traverse and closing error****3.7 Graphical adjustment of closing error****4. Levelling and Contouring****4.1 Basic terminologies:****4.1.1 Level surfaces****4.1.2 Horizontal and vertical surfaces****4.1.3 Datum****4.1.4 Bench Marks- GTS, Permanent, Arbitrary and Temporary****4.1.5 Reduced Level****4.1.6 Rise and Fall method****4.1.7 Line of collimation****4.1.8 Station****4.1.9 Back sight, Fore sight, Intermediate sight****4.1.10 Change point****4.1.11 Height of instruments****4.2 Types of levels:****4.2.1 Dumpy level****4.2.2 Tilting level****4.2.3 Auto level****4.2.4 Digital level****4.3 Components of Dumpy Level and its fundamental axes****4.4 Temporary adjustments of Level****4.5 Types of Levelling Staff: Self-reading staff and Target staff****4.6 Reduce level by Line of collimation and Rise and Fall Method.****4.7 Types of levelling:****4.7.1 Simple levelling****4.7.2 Differential levelling****4.7.3 Fly levelling****4.7.4 Profile levelling****4.7.5 Reciprocal Levelling****4.8 Contour, contour intervals, horizontal equivalent****4.9 Use of contour maps****4.10 Characteristics of contours****4.11 Methods of Contouring: Direct and indirect****5. Measurement of Area and Volume****5.1 Components and use of Digital planimeter****5.2 Measurement of area using digital planimeter****5.3 Measurement of volume of reservoir from contour map**

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.

SEMESTER SCHEME 2020-21

MECHANICS OF MATERIALS

Course Code	CE 3003 (Same as CC/CV 3003)
Course Title	Mechanics of Materials
Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To learn properties of area and structural material properties.
- To understand the concept of stress and strain.
- To calculate shear force, bending moment for different shapes of structural elements and corresponding stresses.
- To understand the concept of buckling loads for short and long columns.

Course outcomes:

After competing this course, student will be able to:

- Articulate practical applications of moment of inertia of symmetrical and unsymmetrical structural sections.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beams and loading conditions.
- Determine the bending and shear stresses in beams under different loading conditions.
- Analyse the column for various loading and end conditions.

Course Content**1. Moment of Inertia****1.1 Moment of inertia (M.I.):****1.1.1 Definition****1.1.2 M.I. of plane lamina****1.1.3 Radius of gyration****1.1.4 Section modulus****1.1.5 Parallel and Perpendicular axes theorems (without derivations)****1.1.6 M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (with derivations)****1.2 Moment of inertia of :****1.2.1 Symmetrical and unsymmetrical I-section****1.2.2 Channel section****1.2.3 T-section****1.2.4 Angle section****1.2.5 Hollow sections****1.2.6 Built up sections about centroidal axes and any other reference axis****1.3 Polar Moment of Inertia of solid circular sections****2. Simple Stresses and Strains****2.1 Definition of rigid, elastic and plastic bodies****2.2 Deformation of elastic body under various forces****2.3 Definitions of :****2.3.1 Stress****2.3.2 Strain****2.3.3 Elasticity****2.3.4 Hook's law****2.3.5 Elastic limit****2.3.6 Modulus of elasticity****2.4 Type of Stresses-Normal, Direct, Bending and Shear****2.5 Nature of stresses i.e. Tensile and Compressive stresses.**

- 2.6 Standard stress strain curve for tor steel bar under tension, Yield stress, Proof stress, Ultimate stress, Strain at various critical points, Percentage elongation and Factor of safety
- 2.7 Deformation of body due to axial force, forces applied at intermediate sections, Maximum and minimum stress induced
- 2.8 Composite section under axial loading
- 2.9 Concept of temperature stresses and strain, Stress and strain developed due to temperature variation in homogeneous simple bar (no composite section)
- 2.10 Longitudinal and lateral strain
- 2.11 Modulus of Rigidity, Poisson's ratio, Biaxial and tri-axial stresses, volumetric strain, change in volume, Bulk modulus (Introduction only)
- 2.12 Relation between modulus of elasticity, modulus of rigidity and bulk modulus (without derivation)

3. Shear Force and Bending Moment

- 3.1 Types of supports, beams and loads
- 3.2 Concept and definition of shear force and bending moment
- 3.3 Relation between load, shear force and bending moment (with derivation)
- 3.4 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point loads, uniformly distributed loads and couple (combination of any two types of loading), point of contra flexure

4. Bending and Shear Stresses in beams

- 4.1 Concept and theory of pure bending, assumptions, flexural equation (with derivation), bending stresses and their nature, bending stress distribution diagram
- 4.2 Concept of moment of resistance and simple numerical problems using flexural equation
- 4.3 Shear stress equation (without derivation)
- 4.4 Relation between maximum and average shear stress for rectangular and circular section
- 4.5 Shear stress distribution diagram
- 4.6 Shear stress distribution for square, rectangular, circle, hollow, square, rectangular, circular, angle sections, channel section, I-section, T section
- 4.7 Simple numerical problems based on shear equation

5. Columns

- 5.1 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
- 5.2 Euler's theory, assumptions made in Euler's theory and its limitations, Application of Euler's equation to calculate buckling load
- 5.3 Rankine's formula and its application to calculate crippling load
- 5.4 Concept of working load/safe load, design load and factor of safety

Suggested learning resources:

1. Bedi D.S., Strength of Materials, Khanna Publishing House, Delhi, Ed. 2018
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
5. Punmia B.C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

BUILDING CONSTRUCTION

Course Code	CE 3004 (Same as CC 3004)
Course Title	Building Construction
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To identify different components of building.
- To understand different types of foundation and their significance.
- To know different types of masonry and their construction.
- To highlight the importance of communications in building planning.

Course outcomes:

After completing this course, student will be able to:

- Identify components of building structures.
- Propose suitable type of foundation for building structures.
- Select suitable type of masonry for building structures.
- Propose relevant means of communications for different types of buildings.
- Select relevant material for finishing works.

Course Content**1. Overview of Building Components****1.1. Classification of Buildings**

1.1.1 As per National Building Code Group A to I

1.1.2 As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure

1.2. Building Components - Functions of Building Components, Substructure – Foundation, Plinth**1.3. Superstructure:**

1.3.1 Walls

1.3.2 Partition wall

1.3.3 Cavity wall

1.3.4 Sill and Lintel

1.3.5 Doors and Windows

1.3.6 Floors

1.3.7 Roof

1.3.8 Columns

1.3.9 Beams

1.3.10 Parapet

1.3.11 Balcony

2. Construction of Substructure**2.1 Job Layout:**

2.1.1 Site Clearance

2.1.2 Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method

2.1.3 Precautions

2.2 Earthwork:

2.2.1 Excavation for Foundation

2.2.2 Timbering and Strutting

2.2.3 Earthwork for embankment

2.2.4 Material for plinth Filling

2.2.5 Tools and plants used for earthwork

2.3 Foundation:

- 2.3.1 Functions of foundation,
- 2.3.2 Types of foundation
 - 2.3.2.1 Shallow Foundation
 - 2.3.2.2 Stepped Footing
 - 2.3.2.3 Wall Footing
 - 2.3.2.4 Column Footing
 - 2.3.2.5 Isolated and Combined Column Footing
 - 2.3.2.6 Raft Foundation
 - 2.3.2.7 Grillage Foundation. (Introduction Only)
 - 2.3.2.8 Deep Foundation - Pile Foundation, Well foundation and Caissons
- 2.3.3 Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams (Introduction only)

3. Construction of Superstructure

3.1 Stone Masonry:

- 3.1.1 Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice
- 3.1.2 Types of stone masonry: Rubble masonry, Ashlar Masonry and their types
 - 3.1.3 Joints in stone masonry and their purpose
- 3.1.4 Selection of Stone Masonry
- 3.1.5 Precautions to be taken in Stone Masonry Construction

3.2 Brick masonry:

- 3.2.1 Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb
- 3.2.2 Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond
- 3.2.3 Requirements of good brick masonry
- 3.2.4 Junctions in brick masonry and their purpose and procedure
- 3.2.5 Precautions to be observed in Brick Masonry Construction
- 3.3 Comparison between stone and Brick Masonry
- 3.4 Tools and plants required for construction of stone and brick masonry
- 3.5 Hollow concrete block masonry and composite masonry

3.6 Scaffolding and Shoring:

- 3.6.1 Purpose
- 3.6.2 Types of Scaffolding
- 3.6.3 Process of Erection and Dismantling
- 3.6.4 Purpose and Types of Shoring, Underpinning

3.7 Formwork:

- 3.7.1 Definition of Formwork
- 3.7.2 Requirements of Formwork
- 3.7.3 Materials used in Formwork,
- 3.7.4 Types of Formwork
- 3.7.5 Removal of formwork

4. Building Communication and Ventilation

4.1 Horizontal Communication:

- 4.1.1 Doors –
 - 4.1.1.1 Components of Doors
 - 4.1.1.2 Full Paneled Doors
 - 4.1.1.3 Partly Paneled and Glazed Doors
 - 4.1.1.4 Flush Doors
 - 4.1.1.5 Collapsible Doors
 - 4.1.1.6 Rolling Shutters
 - 4.1.1.7 Revolving Doors
 - 4.1.1.8 Glazed Doors
 - 4.1.1.9 Sizes of Door recommended by BIS
- 4.1.2 Windows:
 - 4.1.2.1 Component of windows
 - 4.1.2.2 Types of Windows - Full Paneled, Partly Paneled and Glazed, wooden, Steel, Aluminum windows, Sliding

Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight.

4.1.2.3 Sizes of Windows recommended by BIS

4.1.3 Ventilators

4.2 Fixtures and fastenings for doors and windows-Material used and functions of Window Sill and Lintels, Shed / Chajja

4.3 Vertical Communication:

4.3.1 Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators

4.4 Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder

4.5 Types of staircase :

4.5.1 On the basis of shape:

4.5.1.1 Straight

4.5.1.2 Dog-legged

4.5.1.3 Open well

4.5.1.4 Spiral

4.5.1.5 Quarter turn

4.5.1.6 Bifurcated

4.5.1.7 Three quarter turn and

4.5.1.8 Half turn

4.5.2 On the basis of Material:

4.5.2.1 Stone

4.5.2.2 Brick

4.5.2.3 R.C.C.

4.5.2.4 Wooden

4.5.2.5 Metal

5. Building Finishes

5.1 Floors and Roofs:

5.1.1 Types of Floor Finishes and its suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado.

5.1.2 Process of Laying and Construction

5.1.3 Finishing and Polishing of Floors

5.1.4 Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets

5.1.5 Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss, terms used in roofs

5.2 Wall Finishes:

5.2.1 Plastering – Necessity of Plastering

5.2.2 Procedure of Plastering

5.2.3 Single Coat Plaster, Double Coat Plaster

5.2.4 Rough finish, Neeru Finishing

5.2.5 Plaster of Paris (POP)

5.2.6 Special Plasters- Stucco plaster, sponge finish, pebble finish

5.2.7 Plaster Board and Wall Claddings

5.2.8 Precautions to be taken in plastering

5.2.9 Defects in plastering

5.2.10 Pointing – Necessity, Types of pointing and procedure of Pointing

5.2.11 Painting –Necessity, Surface Preparation for painting, Methods of Application

Suggested learning resources:

1. S. P. Arora and Bindra., Building Construction, Dhanpat Rai Publication, Delhi.
2. Sushil Kumar., Building Construction, Standard Publication.
3. Rangawala, S. C., Building Construction, Charotar Publication, Anand.
4. Punmia B. C., and Jain A. K., Building Construction ,Firewall Media.
5. Sharma S. K., Building Construction, S. Chand and Co. Pvt. Ltd., New Delhi.
6. JanardanZha , Building Construction, Khanna Publication.
7. Bhavikatti S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
8. Mantri S., A to Z Building Construction, SatyaPrakashan, New Delhi.

SEMESTER SCHEME 2020-21

CONCRETE TECHNOLOGY

Course Code	CE 3005 (Same as CC /CV3005)
Course Title	Concrete Technology
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

Course outcomes:

After completing this course, student will be able to:

- Use different types of cement and aggregates in concrete
- Prepare concrete of desired compressive strength.
- Prepare concrete of required specification.
- Maintain quality of concrete under different conditions.
- Apply relevant admixtures for concreting.

Course Content:**1.Cement, Aggregates and Water**

- 1.1 Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength.
- 1.2 Different grades of OPC and relevant BIS codes
- 1.3 Testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength
- 1.4 Storage of cement and effect of storage on properties of cement
- 1.5 BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina and White cement
- 1.6 Aggregates: Requirements of good aggregate, Classification according to size and shape
- 1.7 Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383.
- 1.8 Concept of crushed Sand
- 1.9 Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specifications.
- 1.10 Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.

2. Concrete

- 2.1 Concrete: Different grades of concrete, provisions of IS 456.
- 2.2 Duff Abraham water cement (w/c) ratio law, significance of w/c ratio, selection of w/c ratio for different grades, maximum w/c ratio for different grades of concrete for different exposure conditions as per IS 456.
- 2.3 Properties of fresh concrete
 - 2.3.1 Workability: Factors affecting workability of concrete.
- 2.4 Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer.

- 2.5 Value of workability requirement for different types of concrete works
- 2.6 Segregation, bleeding and preventive measures
- 2.7 Properties of Hardened concrete: Strength, Durability, Impermeability

3. Concrete Mix Design and Testing of Concrete

- 3.1 Concrete mix design: Objectives, methods of mix design,
- 3.2 Study of mix design as per IS 10262 (only procedural steps).
- 3.3 Testing of concrete, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results.
- 3.4 Non-destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS13311 (part 1 and 2), Importance of NDT tests

4. Quality Control of Concrete

- 4.1 Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete
- 4.2 Formwork for concreting: Different types of formwork for beams, slabs, columns, materials used for form work,
- 4.3 Requirement of good formwork
- 4.4 Stripping time for removal of formworks per IS 456.
- 4.5 Waterproofing: Importance and need of waterproofing
- 4.6 Methods of waterproofing and materials used for waterproofing
- 4.7 Joints in concrete construction: Types of joints, methods for joining old and new concrete
- 4.8 Introduction to water bars
- 4.9 Materials used for filling joints

5. Chemical Admixture, Special Concrete and Extreme Weather concreting

- 5.1 Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers.
- 5.2 Special Concrete: Properties, advantages and limitation of following types of Special concrete:
 - 5.2.1 Ready mix concrete
 - 5.2.2 Fibre Reinforced concrete
 - 5.2.3 High performance concrete
 - 5.2.4 Self-compacting concrete
 - 5.2.5 Light weight concrete
- 5.3 Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition
- 5.4 Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition

Suggested learning resources:

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

GEOTECHNICAL ENGINEERING

Course Code	CE 3006 (Same as CC/CV 3006)
Course Title	Geotechnical Engineering
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

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 methods

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 results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests.

Course Content:**1.Overview of Geology and Geotechnical Engineering**

- 1.1 Introduction of Geology, Branches of Geology
- 1.2 Importance of Geology for civil engineering structure and composition of earth
- 1.3 Definition of a rock: Classification based on their genesis (mode of origin), formation
- 1.4 Classification and engineering uses of igneous, sedimentary and metamorphic rocks
- 1.5 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures
- 1.6 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam

2.Physical and Index Properties of Soil

- 2.1 Soil as a three-phase system
- 2.2 Water content
- 2.3 Determination of water content by oven drying method as per BIS code
- 2.4 Void ratio, porosity and degree of saturation, density index
- 2.5 Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight
- 2.6 Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method
- 2.7 Determination of specific gravity and water content by pycnometer
- 2.8 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit, Plasticity index
- 2.9 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils
- 2.10 Plasticity chart
- 2.11 BIS classification of soil.

3.Permeability and Shear Strength of Soil

- 3.1 Definition of permeability
- 3.2 Darcy's law of permeability, coefficient of permeability, factors affecting permeability
- 3.3 Determination of coefficient of permeability by constant head and falling head tests
- 3.4 Simple problems to determine coefficient of permeability
- 3.5 Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (No numerical problems)
- 3.6 Shear failure of soil
- 3.7 Concept of shear strength of soil

- 3.8 Components of shearing resistance of soil – cohesion, internal friction
- 3.9 Mohr-Coulomb failure theory
Strength envelope, strength equation for purely cohesive and cohesion less soils
- 3.10 Direct shear and vane shear test –laboratory methods

4. Bearing Capacity of Soil

- 4.1 Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure
- 4.2 Introduction to Terzaghi's analysis and assumptions
- 4.3 Effect of water table on bearing capacity
- 4.4 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888& IS:2131
- 4.5 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure
- 4.6 Rankine's theory and assumptions made for non-cohesive Soils

5. Compaction and stabilization of soil

- 5.1 Concept of compaction, Standard and Modified proctor test as per IS code
- 5.2 Plotting of Compaction curve for determining: Optimum moisture content (OMC), maximum dry density (MDD), Zero air voids line
- 5.3 Factors affecting compaction
- 5.4 Field methods of compaction – rolling, ramming and vibration
- 5.5 Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer and Vibrator
- 5.6 Difference between compaction and consolidation
- 5.7 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization
- 5.8 California bearing ratio (CBR) test - Meaning and Utilization in Pavement Construction
- 5.9 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores
- 5.10 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. Ramamurthy, T.N. & Sitharam, T.G., Geotechnical Engineering (Soil Mechanics), S Chand and Company LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
5. Kasamalkar, B. J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

CONSTRUCTION MATERIAL LAB

Course Code	CE 3007 (Same as CC 3007)
Course Title	Construction Material Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To learn about various construction materials, and understand their relevant characteristics.
- To be able to identify suitability of various materials for different construction purposes.
- To know about natural, artificial, and processed materials available for various purposes of construction activities.

Course outcomes:

After competing this course, student will be able to:

- 1) Identify relevant construction materials.
- 2) Identify relevant natural construction materials.
- 3) Select relevant artificial construction materials.
- 4) Select relevant special type of construction materials.
- 5) Identify and use of processed construction materials.

List of practical to be performed:

1. Identify various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report (60,40, 20,10 mm)
2. Identify the available construction materials in the laboratory on the basis of their sources.
3. Identify the grain distribution pattern in given sample of teak wood in the laboratory and draw the various patterns. (along and perpendicular to the grains)
4. Prepare the lime putty by mixing lime (1 kg) with water in appropriate proportion and prepare report on slaking of lime.
5. Identify various layers and types of soil in foundation pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples. Part I
6. Identify various layers and types of soil in foundation pit by visiting at least 3 construction sites in different locations of city and prepare report consisting photographs and samples. Part II
7. Select first class, second class and third-class bricks from the stake of bricks and prepare report on the basis of its properties.
8. Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained.
9. Identify different types of flooring tiles such as vitrified tiles, ceramic tiles, glazed tiles, mosaic tiles, anti-skid tiles, chequered tiles, paving blocks and prepare report about the specifications.
10. Apply the relevant termite chemical on given damaged sample of timber.
11. Identify the type of glasses from the given samples.
12. Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush/rollers adopting safe practices. Part I
13. Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush/rollers adopting safe practices. Part II
14. Prepare the cement mortar of proportion 1:3 or 1:6 using artificial sand as a special processed construction material.
15. Prepare mortar using cement and Fly ash or Granite/marble polishing waste in the proportion 1:6 or 1:3.

Suggested learning resources:

1. Ghose, D. N., Construction Materials , Tata McGraw Hill, New Delhi.
2. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, New Delhi
3. Varghese, P.C. , Building Materials, PHI learning, New Delhi.
4. Rangwala, S.C., Engineering Materials, Charator publisher, Ahemdabad.
5. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
6. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.
7. Sood H., Laboratory Manual on Testing of Engineering Materials, New Age Publishers, New Delhi.
8. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
9. Duggal, S. K, Building Materials, New International, New Delhi.

SEMESTER SCHEME 2020-21

BASIC SURVEYING LAB

Course Code	CE 3008 (Same as CC 3008)
Course Title	Basic Surveying Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To understand types of surveying works required
- To know the type of method and equipments to be used for different surveys
- To know the use and operational details of various surveying equipments.

Course outcomes:

After completing this course, student will be able to:

- Select the type of survey required for given situation.
- Compute area of open field using chain, tape and cross staff.
- Conduct traversing in the field using chain and compass.

List of Practicals to be performed

1. Measure distance between two survey stations using chain, tape and ranging rods when two stations are inter visible.
2. Undertake reciprocal ranging and measure the distance between two stations.
3. Determine area of open field using chain and cross staff survey.
4. Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.
5. Measure Fore Bearing and back bearing of a closed traverse of 5 or 6 sides and correct the bearings and included angles for the local attraction.
6. Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides around a building.
7. Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical **No.6.**
8. Undertake simple leveling using dumpy level/ Auto level and leveling staff.
9. Undertake differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level/Auto Level and leveling staff.
10. Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff.
11. Undertake Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval.
12. Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned at practical **No.11.**
13. Undertake Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m.
14. Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical **No.13.**
15. Measure area of irregular figure using Digital planimeter.

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 VidyarthiGruhPrakashan.
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.VenugopalaAkella, Vijayalakshmi, Textbook of Surveying, PHI Learning
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R , Surveying Vol. I, Standard Book House

- level to prepare contour maps
- Use digital planimeter to calculate the areas.

SEMESTER SCHEME 2020-21

MECHANICS OF MATERIALS LAB

Course Code	CE 3009 (Same as CC/CV 3009)
Course Title	Mechanics of Materials Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To know the procedure for the conduct of tensile and compressive strength.
- To understand the concept of stress and strain through testing of different materials.
- To calculate shear force, bending moment and their corresponding stresses.
- To understand flexural strength and abrasive properties of floor tiles.

Course outcomes:

After competing this course, student will be able to:

- Test different Civil engineering materials on Universal Testing Machine.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beam sections and different loading conditions.
- Determine bending and shear stresses in beams under different loading conditions.
- Calculate flexural strength of different types of floor tiles.

List of Practicals to be performed:

1. Study and understand the use and components of Universal Testing Machine (UTM).
2. Perform Tension test on mild steel as per IS:432(1).
3. Perform tension test on Tor steel as per IS:1608, IS:1139.
4. Conduct compression test on sample test piece using Compression Testing Machine.
5. Conduct Izod Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS:1598.
6. Conduct Charpy Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /cast iron etc as per IS:1757.
7. Determine Water Absorption on bricks per IS:3495 (part II), IS:1077 or tile IS:1237.
8. Determine Compressive strength of dry and wet bricks as per IS:3495(part I), IS:1077.
9. Conduct Abrasion Test on flooring tiles (any one) e.g. Mosaic tiles, Ceramic Tiles as per IS: 13630 (part7), Cement Tile as per IS: 1237.
10. Perform Single Shear and double shear test on any two metals e.g. Mild steel/ brass/aluminium/copper / cast iron etc as per IS:5242.
11. Conduct Compression test on timber section along the grain and across the grain as per IS:2408.
12. Plot Shear force and Bending Moment diagrams for cantilever, simply supported beams.
13. Plot Shear force and Bending Moment diagrams for overhanging beams for different types of loads including moment loading.
14. Conduct Flexural test on timber beam on rectangular section in both orientation as per IS:1708, IS:2408.
15. Conduct Flexure test on floor tiles IS:1237,IS:13630 or roofing tiles as per IS:654,IS:2690.

Suggested learning resources:

1. Bedi D.S., Strength of Materials, Khanna Publishing House, New Delhi (Edition 2018)
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, DhanpatRai and sons, New Delhi.
5. Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

SEMESTER SCHEME 2020-21

CONCRETE TECHNOLOGY LAB

Course Code	CE 3010 (Same as CC/CV 3010)
Course Title	Concrete Technology Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

Course Objectives:

Following are the objectives of this course:

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

Course outcomes:

After completing this course, student will be able to:

- Identify different types of cement by performing laboratory tests.
- Know the physical properties of fine and coarse aggregates.
- Prepare concrete of required specification.
- Maintain the quality of concrete applying scientific principles.
- Use relevant admixtures for improving the workability of concrete.

List of Practical to be performed:

1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.
2	Determine specific gravity, standard consistency, initial and final setting times of cement.
3	Determine compressive strength of cement.
4	Determine silt content in sand.
5	Determine bulking of sand.
6	Determine bulk density of fine and coarse aggregates.
7	Determine water absorption of fine and coarse aggregates.
8	Determine Fineness modulus of fine aggregate by sieve analysis.
9	Determine elongation and flakiness index of coarse aggregates
10	Determine workability of concrete by slump cone test.
11	Determine workability of concrete by compaction factor test.
12	To prepare concrete mix of a particular grade and determine compressive strength of concrete for 7 and 28 days.
13	Demonstration of NDT equipments

Suggested learning resources:

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

GEOTECHNICAL ENGINEERING LAB

Course Code	CE 3011 (Same as CC/CV 3011)
Course Title	Geotechnical Engineering Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

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.

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.

List of Practicals to be performed:

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 and water content 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. Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS 2720 (Part- IV).
8. 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.
9. Determine coefficient of permeability by constant head test as per IS 2720 (Part- XVII).
10. Determine coefficient of permeability by falling head test as per IS 2720 (Part- XVII).
11. Determine shear strength of soil by direct shear test as per IS 2720 (Part-XIII).
12. Determine shear strength of soil by vane shear test as per IS 2720 (Part-XXX).
13. Determine MDD and OMC by standard proctor test of given soil sample as per IS 2720 (Part- VII).

Suggested learning resources:

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

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR
SEMESTER SCHEME-2020-21



IV SEMESTER
(SESSION 2021-2022 & ONWARDS)

HYDRAULICS

Course Code	CE 4001 (Same as CC/CV 4001)
Course Title	Hydraulics
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Measure pressure and determine total hydrostatic pressure for different conditions.
2. Understand various parameters associated with fluid flow
3. Determine head loss of fluid flow through pipes.
4. Find the fluid flow parameters in open channels.
5. Select relevant hydraulic pumps for different applications

COURSE CONTENT**1. Pressure Measurement and Hydrostatic Pressure**

- 1.1. Technical terms used in Hydraulics:
 - 1.1.1. Fluid, Fluid Mechanics
 - 1.1.2. Hydraulics, Hydrostatics and Hydrodynamics
 - 1.1.3. Ideal and Real Fluid
 - 1.1.4. Application of Hydraulics
- 1.2. Physical Properties of Fluid:
 - 1.2.1. Density-Specific Volume
 - 1.2.2. Specific Gravity
 - 1.2.3. Vapour pressure, Surface Tension, Capillarity
 - 1.2.4. Viscosity - Newton's Law of Viscosity, Dynamic and Kinematic viscosity
- 1.3. Various Types of Pressure:
 - 1.3.1. Atmospheric Pressure
 - 1.3.2. Gauge Pressure
 - 1.3.3. Absolute Pressure
 - 1.3.4. Vacuum Pressure
- 1.4. Concept of Pressure Head and its unit
- 1.5. Pascal's law of fluid pressure and its uses
- 1.6. Measurement of Differential Pressure
 - 1.6.1. Manometers
 - 1.6.1.1 Piezometer - its limitation
 - 1.6.1.2 U-tube - simple, differential, inverted
 - 1.6.1.3 Micro-manometers
 - 1.6.1.4 Inclined tube micro-manometers
- 1.1. Variation of Pressure with Depth:
 - 1.1.1. Pressure Diagram
 - 1.1.2. Hydrostatic Pressure
 - 1.1.3. Center of Pressure on immersed surfaces and on tank walls

2. FLUID FLOW PARAMETERS

- 2.1 Types of flow
 - 2.1.1 Gravity and Pressure Flow
 - 2.1.2 Laminar, Turbulent
 - 2.1.3 Uniform, Non-uniform
 - 2.1.4 Steady, Unsteady flow
- 2.2 Reynolds Number
- 2.3 Discharge and its unit
- 2.4 Continuity Equation of Flow
- 2.5 Energy of flowing Liquid
 - 2.5.1 Potential
 - 2.5.2 Kinetic
 - 2.5.3 Pressure Energy
- 2.6 Bernoulli's Theorem: Statement, Assumptions, Equation

3. FLOW THROUGH PIPES

- 3.1 Major Head Loss in Pipe
 - 3.1.1 Frictional loss and its computation by Darcy's Weisbach Equation
- 3.2 Minor Losses in Pipe
 - 3.2.1 Loss at Entrance, Exit
 - 3.2.2 Sudden Contraction, Sudden Enlargement
 - 3.2.3 Fittings
- 3.3 Flow through Pipes
 - 3.3.1 Pipes in Series
 - 3.3.2 Pipes in Parallel
 - 3.3.3 Dupuit's equation for Equivalent Pipe
- 3.4 Hydraulic Gradient Line and Total Energy Line
- 3.5 Water Hammer in Pipes: Causes and Remedial measures
- 3.6 Discharge measuring device for Pipe Flow: Venturimeter - construction and working
- 3.7 Discharge measurement using Orifice, Hydraulic Coefficients of Orifice

4. FLOW THROUGH OPEN CHANNEL

- 4.1 Geometrical properties of channel section
 - 4.1.1 Wetted Area
 - 4.1.2 Wetted Perimeter
 - 4.1.3 Hydraulic Radius for Rectangular and Trapezoidal Channel Section
- 4.2 Determination of discharge by Chezy's equation and Manning's equation
- 4.3 Conditions for Most Economical Rectangular and Trapezoidal Channel Section
- 4.4 Discharge measuring devices:
 - 4.4.1 Triangular Notch
 - 4.4.2 Rectangular Notch
- 4.5 Velocity measurement devices
 - 4.5.1 Current Meter
 - 4.5.2 Floats
 - 4.5.3 Pitot's Tube
- 4.6 Froude Number

5. HYDRAULIC PUMPS

- 5.1 Concept of Pump
- 5.2 Types of Pump
 - 5.2.1 Centrifugal
 - 5.2.2 Reciprocating
 - 5.2.3 Submersible
- 5.3 Suction Head, Delivery Head, Static Head, Manometric Head
Selection and choice of pump

SUGGESTED LEARNING RESOURCES

1. Modi, P. N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Company, New Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

(SEMESTER SCHEME-2020-21)

ADVANCED SURVEYING

Course Code	CE 4002(Same as CC 4002)
Course Title	Advanced Surveying
Number of Credits	2 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES:

Following are the objectives of this course:

- To know methods of Plane Surveying and Theodolite Surveying and their uses
- 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

COURSE OUTCOMES

After completing this course, student will be able to:

1. Prepare plans using Plane Table Surveys.
2. Prepare plans using Theodolite Surveys.
3. Find distances and elevations using Tachometer.
4. Prepare plans using Total Station instrument.
5. Locate coordinates of stations using GPS.

COURSE CONTENT**1. Plane Table Surveying**

- 1.1 Principles of Plane Table Survey
- 1.2 Accessories of Plane Table and their use, Telescopic Alidade
- 1.3 Setting of Plane Table
 - 1.3.1 Orientation of Plane Table
 - 1.3.2 Back Sighting and Magnetic Meridian Method
 - 1.3.3 True Meridian Method
- 1.4 Methods of Plane Table Surveys
 - 1.4.1 Radiation
 - 1.4.2 Intersection
 - 1.4.3 Traversing
- 1.5 Merits and Demerits of Plane Table Survey

2. Theodolite Surveying

- 2.1 Types and uses of Theodolite
- 2.2 Components of Transit Theodolite and their functions
- 2.3 Reading the Vernier of Transit Theodolite
- 2.4 Technical Terms
 - 2.4.1 Swinging
 - 2.4.2 Transiting
 - 2.4.3 Face left
 - 2.4.4 Face right
- 2.5 Fundamental Axes of Transit Theodolite and their Relationship
- 2.6 Temporary Adjustment of Transit Theodolite
- 2.7 Measurement of Horizontal Angle by
 - 2.7.1 Direct
 - 2.7.2 Repetition Method
 - 2.7.3 Errors Eliminated by Method of Repetition
- 2.8 Measurement of Magnetic Bearing of a line
 - 2.8.1 Prolonging and ranging a line,
 - 2.8.2 Deflection Angle.
 - 2.8.3 Measurement of Vertical Angle
- 2.9 Theodolite traversing by
 - 2.9.1 Included Angle method

- 2.9.2 Deflection Angle Method
- 2.10 Checks for open and closed traverse
- 2.11 Calculations of Bearing from Angles
- 2.12 Traverse Computation
 - 2.12.1 Latitude, Departure
 - 2.12.2 Consecutive Coordinates, Independent Coordinates
- 2.13 Balancing the Traverse by
 - 2.13.1 Bowditch's Rule
 - 2.13.2 Transit Rule
 - 2.13.3 Gale's Traverse Table Computation
- 3. Tacheometric Surveying and Curve setting**
 - 3.1 Principles of Tacheometry
 - 3.1.1 Tacheometer and its component parts
 - 3.1.2 Anallatic lens
 - 3.2 Tacheometric formula for horizontal distance with telescope horizontal and staff vertical
 - 3.3 Field method for determining constants of Tacheometer
 - 3.4 Determining horizontal and vertical distances with Tacheometer by
 - 3.4.1 Fixed hair method and
 - 3.4.2 Staff held vertical
 - 3.5 Limitations of Tacheometry
 - 3.6 Types of curves used in roads and railway alignments
 - 3.7 Designation of curves
 - 3.8 Setting simple circular curve by
 - 3.8.1 Offsets from long chord
 - 3.8.2 Rankine's method of deflection angles
- 4. Advanced Surveying Equipments**
 - 4.1 Principle of Electronic Distance Meter (EDM)
 - 4.1.1 Its component parts and their Functions
 - 4.1.2 Use of EDM
 - 4.2 Use of
 - 4.2.1 Micro Optic Theodolite
 - 4.2.2 Electronic Digital Theodolite
 - 4.3 Use of Total Station
 - 4.3.1 Use of function keys
 - 4.3.2 Measurements of Horizontal angles, Vertical Angles
 - 4.3.3 Distances and Coordinates using Total Station
 - 4.3.4 Traversing, Profile Survey and Contouring with Total Station
- 5. Remote Sensing, GPS and GIS**
 - 5.1 Remote Sensing
 - 5.1.1 Overview
 - 5.1.2 Remote Sensing System
 - 5.1.3 Applications of Remote Sensing in Civil engineering
 - 5.1.4 Land use / Land cover
 - 5.1.5 Mapping, Disaster Management
 - 5.2 Use of Global Positioning System (G.P.S.) instruments
 - 5.3 Geographic Information System (GIS)
 - 5.3.1 Over view
 - 5.3.2 Components
 - 5.3.3 Applications
 - 5.3.4 Name of common Softwares for GIS
 - 5.4 Introduction to Drone Surveying

SUGGESTED LEARNING RESOURCES

1. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling Part I and II, Pune Vidyarthi GruhPrakashan, 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. De, Alak, Plane Surveying, S.Chand Publications, New Delhi.

(SEMESTER SCHEME-2020-21)

THEORY OF STRUCTURES

Course Code	CE 4003 (Same as CC 4003)
Course Title	Theory of Structures
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn concept of eccentric loading and stresses in vertical members like column, chimneys, dam
- To analyze beams using various methods like slope deflection, three moment, and moment distribution
- To understand different methods of finding axial forces in trusses.

Course Outcomes

After competing this course, student will be able to:

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

COURSE CONTENT**1. Direct and Bending Stresses in vertical members**

- 1.1 Introduction to axial and eccentric loads
- 1.2 Eccentricity about one principal axis only
 - 1.2.1 Nature of Stresses
 - 1.2.2 Maximum and minimum stresses
 - 1.2.3 Resultant stresses and distribution diagram
 - 1.2.4 Condition for no tension or zero stress at extreme fiber
 - 1.2.5 Limit of Eccentricity
 - 1.2.6 Core of section for rectangular and circular cross sections
 - 1.2.7 Middle Third Rule

2. SLOPE AND DEFLECTION

- 2.1 Concept of slope and deflection
- 2.2 Stiffness of beams
- 2.3 Relation among bending moment, slope, deflection and radius of curvature, (no derivation).
- 2.4 Double integration method to find slope and deflection of cantilever and simply supported beams subjected to
 - 2.4.1 Concentrated load and
 - 2.4.2 Uniformly distributed load on entire span.

3. FIXED AND CONTINUOUS BEAM

- 3.1 Concept of fixity, effect of fixity
- 3.2 Advantages and disadvantages of fixed beam over simply supported beam
- 3.3 Principle of Superposition
- 3.4 Fixed End Moments from first principle for beam subjected to
 - 3.4.1 Point load
 - 3.4.2 UDL over entire span
- 3.5 Application of standard formulae for a fixed beam in finding
 - 3.5.1 End moments
 - 3.5.2 End reactions
 - 3.5.3 Drawing S.F. and B.M. diagrams
- 3.6 Definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical examples.

4. ROLLING LOAD AND INFLUENCE LINE

- 4.1 Introduction to Influence line diagram for simply supported beams

- 4.1.1 Reaction
- 4.1.2 Shear force
- 4.1.3 Bending moment
- 4.2 Drawing of maximum B.M.D. and S.F.D. for simply supported beam for rolling loads of
 - 4.2.1 Single concentrated load
 - 4.2.2 Two point loads
 - 4.2.3 Series of point loads

5. SIMPLE TRUSSES

- 5.1 Types of Trusses
 - 5.1.1 Simple
 - 5.1.2 Fink
 - 5.1.3 Compound fink
 - 5.1.4 French Truss
 - 5.1.5 Pratt Truss
 - 5.1.6 Howe Truss
 - 5.1.7 North Light Truss
 - 5.1.8 King Post and Queen Post Truss
- 5.2 Calculate support reactions for trusses subjected to point loads at joints.
- 5.3 Calculate forces in members of truss using
 - 5.3.1 Method of Joints

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, Tata McGraw Hill, New Delhi.
6. Agor R, Structural Analysis, Khanna Publishing House, Delhi.

BUILDING PLANNING AND DRAWING

Course Code	CE 4004 (Same as CC 4004)
Course Title	Building Planning and Drawing
Number of Credits	1 (L: 1, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn basic principles of building planning and drawing.
- To know graphical representation of various components of buildings.
- To draw complete plan and elevation of a building.
- To learn basics of perspective drawings and Computer Aided Drawings.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Interpret the symbols, signs and conventions from the given drawing.
2. Prepare line plans of residential and public buildings using principles of planning.
3. Prepare submission and working drawing for the given requirement of Load Bearing Structure.
4. Prepare submission and working drawing using CAD for the given requirement of Framed Structure.
5. Draw two-point perspective drawing for given small objects.

COURSE CONTENT**1. Conventions and Symbols**

- 1.1. Conventions as per IS 962,
- 1.2. Symbols for different materials such as
 - 1.2.1 Earthwork
 - 1.2.2 Brickwork
 - 1.2.3 Stonework
 - 1.2.4 Concrete
 - 1.2.5 Woodwork
 - 1.2.6 Glass.
- 1.3. Graphical symbols for doors and windows
- 1.4. Abbreviations, symbols for sanitary and electrical installations
- 1.5. Types of lines
 - 1.5.1 Visible lines
 - 1.5.2 Centre line
 - 1.5.3 Hidden line
 - 1.5.4 Section line
 - 1.5.5 Dimension line
 - 1.5.6 Extension line
 - 1.5.7 Pointers
 - 1.5.8 Arrow head or Dots
- 1.6. Appropriate size of lettering and numerals for titles, sub-titles, notes and dimensions.
- 1.7. Types of Scale
 - 1.7.1 Monumental
 - 1.7.2 Intimate
 - 1.7.3 Criteria for Proper Selection of scale for various types of drawing.
- 1.8. Sizes of various standard papers/sheets.

2. Planning of Building

- 2.1 Principles of Planning for Residential and Public Building
 - 2.1.1 Aspect
 - 2.1.2 Prospect
 - 2.1.3 Orientation
 - 2.1.4 Grouping

- 2.1.5 Privacy
- 2.1.6 Elegance
- 2.1.7 Flexibility
- 2.1.8 Circulation
- 2.1.9 Furniture Requirements
- 2.1.10 Sanitation
- 2.1.11 Economy
- 2.2 Space requirement and norms for minimum dimension of different units in the residential and public buildings as per IS 962
- 2.3 Rules and Bye-laws of sanctioning authorities for construction work.
- 2.4 Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio).
- 2.5 Line Plans for Residential Building of minimum three rooms including water closet (WC), bath and staircase as per principles of planning.
- 2.6 Line Plans for Public Building
 - 2.6.1 School Building
 - 2.6.2 Primary Health Centre
 - 2.6.3 Restaurant
 - 2.6.4 Bank
 - 2.6.5 Post Office
 - 2.6.6 Hostel
 - 2.6.7 Function Hall
 - 2.6.8 Library

3. Drawing of Load Bearing Structure

- 3.1 Drawing of Single Storey Load Bearing Residential Building (2 BHK) with staircase
- 3.2 Data Drawing
 - 3.2.1 Plan
 - 3.2.2 Elevation
 - 3.2.3 Section
 - 3.2.4 Site plan
 - 3.2.5 Schedule of openings
 - 3.2.6 Construction notes with specifications
 - 3.2.7 Area statement
 - 3.2.8 Planning and Design of Staircase: Rise and Tread for Residential and Public Building
- 3.3 Working Drawing
 - 3.4.1 Developed Plan
 - 3.4.2 Elevation
 - 3.4.3 Section passing through Staircase or WC and Bath
- 3.5 Foundation Plan of Load Bearing Structure

4. Drawing of Framed Structure

- 4.1 Drawing of
 - 4.1.1 Two Storeyed Framed Structure (G+1)
 - 4.1.2 Residential building (2 BHK) with staircase.
- 4.2 Data Drawing
 - 4.2.1 Developed Plan
 - 4.2.2 Elevation
 - 4.2.3 Section
 - 4.2.4 Site plan
 - 4.2.5 Schedule of openings
 - 4.2.6 Construction notes with specifications
 - 4.2.7 Area statement
 - 4.2.8 Planning and Design of Staircase– Rise and Tread for residential and public building
- 4.3 Working Drawing of Framed Structure
 - 4.3.1 Developed Plan
 - 4.3.2 Elevation
 - 4.3.3 Section passing through staircase or WC and bath

4.4 Foundation Plan of Framed Structure

4.5 Details of

- 4.5.1 RCC footing
- 4.5.2 Column
- 4.5.3 Beam
- 4.5.4 Chajjas
- 4.5.5 Lintel
- 4.5.6 Staircase
- 4.5.7 Slab

4.6 Drawing with CAD

- 4.6.1 Draw Commands
- 4.6.2 Modify Commands
- 4.6.3 Layer Commands

5. Perspective Drawing

- 5.1 Definition
- 5.2 Types of Perspective
- 5.3 Terms used in Perspective Drawing
- 5.4 Principles used in Perspective Drawing
- 5.5 Two Point Perspective of small objects only such as
 - 5.5.1 Steps
 - 5.5.2 Monuments
 - 5.5.3 Pedestals**

SUGGESTED LEARNING RESOURCES

1. Shah. M.G. Kale, CM, Patki, S.Y., Building Drawing, Mcgraw Hill Publishing company Ltd. New Delhi.
2. Malik and Mayo, Civil Engineering Drawing, Computech Publication Ltd New Asian Publishers, New Delhi.
3. M. G. Shah and C. M. Kale, Principles of Perspective Drawing, Mcgraw Hill Publishing company Ltd. New Delhi.
4. Swamy, Kumara; Rao, N, Kameshwara, A ., Building Planning and Drawing, Charotar Publication, Anand.
5. Bhavikatti, S. S., Building Construction, Vikas Publication House Pvt. Ltd., New Delhi.
6. Mantri, Sandip, A to Z Building Construction, Satya Prakashan, New Delhi.
7. Singh, Ajit, Working with Auto CAD 2000, Mcgraw Hill Publishing company Ltd. New Delhi.
8. Sane, Y.S., Planning and design of Building, Allied Publishers, New Delhi.

WATER RESOURCES ENGINEERING

Course Code	CE 4005 Same as CV 4005
Course Title	Water Resources Engineering
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn estimation of hydrological parameters.
- To understand water demand of crops and provisions to meet the same.
- To know planning of reservoirs and dams.
- To design irrigation projects, canals and other diversion works.

Course Outcomes:

After completing this course, student will be able to:

1. Estimate hydrological parameters.
2. Estimate crop water requirements of a command area and capacity of canals.
3. Execute Minor and Micro Irrigation Schemes.
4. Select the relevant Cross Drainage works for the specific site conditions.
5. Design, construct and maintain simple irrigation regulatory structures.

COURSE CONTENT**1. Introduction to Hydrology**

- 1.1 Hydrology: Definition and Hydrological Cycle
- 1.2 Rain Gauge
 - 1.2.1 Symons Rain Gauge
 - 1.2.2 Automatic Rain Gauge
- 1.3 Methods of Calculating Average Rainfall
 - 1.3.1 Arithmetic Mean
 - 1.3.2 Isohyetal
- 1.4 Runoff
 - 1.4.1 Factors affecting Run off
 - 1.4.2 Computation of Run off

2. Crop Water Requirement and Reservoir Planning

- 2.1 Irrigation and its Classification
- 2.2 Crop Water Requirement
 - 2.2.1 Cropping Seasons
 - 2.2.2 Crop Period
 - 2.2.3 Base Period
 - 2.2.4 Duty
 - 2.2.5 Delta
 - 2.2.6 CCA
 - 2.2.7 GCA
 - 2.2.8 Intensity of Irrigation
 - 2.2.9 Factors Affecting Duty
 - 2.2.10 Problems on Water Requirement and Capacity of Canal
- 2.3 Methods of Application of Irrigation Water and its Assessment
- 2.4 Surveys for Irrigation Project, Data Collection for Irrigation Project
- 2.5 Silting of Reservoir
 - 2.5.1 Rate of Silting
 - 2.5.2 Factors affecting Silting and Control Measures

3. Dams and Spillways

- 3.1 Dams and its Classification
 - 3.1.1 Earthen Dams
 - 3.1.2 Gravity Dams (masonry and concrete)

- 3.2 Earthen Dams
- 3.3 Spillways
 - 3.3.1 Definition
 - 3.3.2 Energy Dissipaters

4. Minor and Micro Irrigation

- 4.1 Percolation Tanks – Need, Selection of site
- 4.2 Lift Irrigation Scheme
 - 4.2.1 Components and their Functions
 - 4.2.2 Lay Out
- 4.3 Drip and Sprinkler Irrigation
 - 4.3.1 Need
 - 4.3.2 Components and Layout
- 4.4 Well Irrigation
 - 4.4.1 Types and Yield of Wells
 - 4.4.2 Advantages and Disadvantages of Well Irrigation

5. Diversion Head Works & Canals

- 5.1 Weirs
 - 5.1.1 Components
 - 5.1.2 Parts
 - 5.1.3 Types
 - 5.1.4 K.T. Weir: Components and Construction
- 5.2 Diversion Head Works
 - 5.2.1 Layout
 - 5.2.2 Components and their functions
- 5.3 Barrages
 - 5.3.1 Components and their functions
 - 5.3.2 Difference between Weir and Barrage
- 5.4 Canals
 - 5.4.1 Classification according to Alignment and Position in the Canal Network
 - 5.4.2 Cross section of Canal in Embankment and Cutting
 - 5.4.3 Partial Embankment and Cutting
 - 5.4.4 Balancing Depth
- 5.5 Canal lining
 - 5.5.1 Purpose
 - 5.5.2 Material used and its properties
 - 5.5.3 Advantages
- 5.6 Cross Drainage Works
 - 5.6.1 Aqueduct
 - 5.6.2 Siphon Aqueduct
 - 5.6.3 Super Passage
 - 5.6.4 Level Crossing
- 5.7 Canal Regulators
 - 5.7.1 Head Regulator
 - 5.7.2 Cross Regulator
 - 5.7.3 Escape
 - 5.7.4 Falls and Outlets

SUGGESTED LEARNING RESOURCES

1. Punmia, B.C., Pande, B, Lal, Irrigation and Water Power Engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. Mutreja K N, Applied Hydrology, McGraw Hill
4. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand
5. Basak, N.N., Irrigation Engineering, McGraw Hill Education
6. Asawa, G.L., Irrigation and water resource Engineering, New Age
7. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
8. Garg, S K, Irrigation and Hydraulic Structures, Khanna Publishers, Delhi.
9. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

(SEMESTER SCHEME-2020-21)

TRANSPORTATION ENGINEERING

Course Code	CE 4006 (Same as CC 4006)
Course Title	Transportation Engineering
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To identify the types of roads as per IRC recommendations.
- To understand the geometrical design features of different highways.
- To perform different tests on road materials.
- To identify the components of railway tracks.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Identify the types of roads as per IRC recommendations.
2. Implement the geometrical design features of different highways.
3. Perform different tests on road materials.
4. Identify the components of railway tracks.
5. Identify the defects in railway tracks.

COURSE CONTENT**1. Overview of Highway Engineering**

- 1.1 Role of Transportation in the Development of Nation, Scope and Importance of Roads in India and its' Characteristics
- 1.2 Different Modes of Transportation
 - 1.2.1 Land way
 - 1.2.2 Waterway
 - 1.2.3 Airway
 - 1.2.4 Merits and Demerits of Roadway and Railway
- 1.3 General Classification of Roads
- 1.4 Selection and factors affecting Road Alignment

2. Geometric Design of Highway

- 2.1 Camber
 - 2.1.1 Definition
 - 2.1.2 Purpose
 - 2.1.3 Types as per IRC recommendations
- 2.2 Kerbs
 - 2.2.1 Road Margin
 - 2.2.2 Road Formation
 - 2.2.3 Right of Way
- 2.3 Design Speed and various factors affecting design speed as per IRC recommendations.
- 2.4 Gradient
 - 2.4.1 Definition
 - 2.4.2 Types as per IRC recommendations
- 2.5 Sight Distance (SSD)
 - 2.5.1 Definition
 - 2.5.2 Types as per IRC recommendations
- 2.6 Curves
 - 2.6.1 Necessity
 - 2.6.2 Types: Horizontal, Vertical Curves, Transition Curves

- 2.7 Extra widening of Roads,
- 2.8 Super Elevation
 - 2.8.1 Definition
 - 2.8.2 Method of providing Super Elevation.

3. Construction of Road Pavements

- 3.1 Types of Road Materials and their Tests
 - 3.1.1 Test on Aggregates
 - 3.1.1.1 Flakiness and Elongation Index Tests
 - 3.1.1.2 Angularity Number Test
 - 3.1.2 Test on Bitumen
 - 3.1.2.1 Penetration
 - 3.1.2.2 Ductility
 - 3.1.2.3 Flash and Fire Point Test
 - 3.1.2.4 Softening Point Test
- 3.2 Pavement
 - 3.2.1 Definition
 - 3.2.2 Types
 - 3.2.3 Structural Components of Pavement and their functions
- 3.3 Construction of WBM Road.
- 3.4 Merits and demerits of WBM & WMM Road
- 3.5 Construction of Flexible Pavement / Bituminous Road
- 3.6 Types of Bitumen and its properties, Emulsion, Cutback, Tar.
- 3.7 Terms used in Bituminous Roads
 - 3.7.1 Prime Coat
 - 3.7.2 Tack Coat
 - 3.7.3 Seal Coat
- 3.8 Merits and Demerits of Bituminous Roads
- 3.9 Cement Concrete Road
 - 3.9.1 Methods of Construction
 - 3.9.2 Alternate and Continuous Bay Method
 - 3.9.3 Construction Joints
 - 3.9.4 Filler and Sealers
 - 3.9.5 Merits and Demerits of Concrete Roads
 - 3.9.6 Types of Joints

4. Basics of Railway Engineering

- 4.1 Permanent Way
 - 4.1.1 Ideal Requirement
 - 4.1.2 Components
 - 4.1.3 Rail Gauge, types, factors affecting selection of a gauge.
- 4.2 Rail, Rail Joints – Requirements, Types.
- 4.3 Creep of Rail: Causes and Prevention.
- 4.4 Sleepers
 - 4.4.1 Functions and Requirement
 - 4.4.2 Types, Concrete Sleepers and their density
- 4.5 Ballast
 - 4.5.1 Function and Types
 - 4.5.2 Suitability
- 4.6 Rail Fixtures and Fastenings
 - 4.6.1 Fish Plate
 - 4.6.2 Spikes
 - 4.6.3 Bolts, Keys
 - 4.6.4 Bearing Plates
 - 4.6.5 Chairs: Types of Anchors and Anti-creepers.

5. Track geometrics, Construction and Maintenance

- 5.1 Alignment - Factors governing Rail Alignment.

5.2 Track Cross Sections

5.2.1 Standard cross section of single and double line in cutting and embankment.

5.2.2 Important Terms

- 5.2.2.1 Permanent Land
- 5.2.2.2 Formation Width
- 5.2.2.3 Side Drains

5.3 Railway Track Geometrics

5.3.1 Gradient

5.3.2 Curves- Types and factors affecting

5.3.3 Grade Compensation

5.3.4 Super Elevation

5.3.5 Limits of Super Elevation on Curves

5.3.6 Cant Deficiency

5.3.7 Negative Cant

5.3.8 Coning of Wheel

5.3.9 Tilting of Rail

5.4 Branching of Tracks, Points and Crossings, Turn out- types, components, functions and inspection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle.

5.5 Station

SUGGESTED LEARNING RESOURCES

1. L.R. Kadiyali, Transportation Engineering, Khanna Book Publishing Co., Delhi (ISBN: 978-93-82609-858) Edition 2018
2. Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering, Nem Chand and Brothers, Roorkee.
3. Arora, N. L., Transportation Engineering, Khanna Publishers, Delhi.
4. Saxena S C and Arora S P, A Textbook of Railway Engineering, Dhanpat Rai Publication.
5. Birdi, Ahuja, Road, Railways, Bridge and Tunnel Engg ,Standard Book House, New Delhi.
6. Sharma, S.K., Principles, Practice and Design of Highway Engineering,, S. Chand Publication, New Delhi.
7. Duggal, Ajay K. and Puri, V. P., Laboratory Manual in Highway Engineering,New Age International (P) Limited, Publishers, New Delhi.
8. Subramanian, K.P., Highway, Railway, Airport and Harbour Engineering, Scitech Publications, Hyderabad.

CONSTRUCTION MANAGEMENT

Course Code	CE 40071 (Same as CC/CV 40071)
Course Title	Construction Management
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand the contract management and associated labour laws.
- To prepare and understand the principles involved in site layout.
- To know the procedure for scheduling of various activities in construction project.
- To understand the labour laws, procedure for arbitration, settlements.
- To know different safety measures in construction projects.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Understand the contract management and associated labour laws.
2. Prepare and understand the nuances of executing the site layout.
3. Prepare networks and bar charts for the given construction project.
4. Understand the intricacies of disputes, related arbitration and settlement laws.

Apply safety measures at construction projects

COURSE CONTENT**1. Construction Industry and Management**

- 1.1 Organization
 - 1.1.1 Objectives
 - 1.1.2 Principles of Organization
 - 1.1.3 Types of Organization
 - 1.1.3.1 Government/Public
 - 1.1.3.2 Private Construction Industry
 - 1.1.4 Role of Various Personnel in Construction Organization
- 1.2 Agencies associated with Construction Work
 - 1.2.1 Owner,
 - 1.2.2 Promoter
 - 1.2.3 Builder
 - 1.2.4 Designer
 - 1.2.5 Architects
- 1.3 Role of Consultant for Various Activities
 - 1.3.1 Preparation of Detailed Project Report (DPR)
 - 1.3.2 Monitoring of Progress and Quality
 - 1.3.3 Settlement of Disputes

2. Site Layout

- 2.1 Principles governing Site Layout
- 2.2 Factors affecting Site Layout
- 2.3 Preparation of Site Layout
- 2.4 Land acquisition procedures and providing compensation

3. Planning and Scheduling

- 3.1 Identifying broad activities in construction work & allotting time to it
 - 3.1.1 Methods of Scheduling
 - 3.1.2 Development of Bar Charts
 - 3.1.3 Merits&Limitations of Bar Charts
- 3.2 Elements of Network
 - 3.2.1 Event
 - 3.2.2 activity

- 3.2.3 dummy activities
- 3.2.4 Precautions in drawing Network
- 3.2.5 Numbering the events
- 3.3 CPM networks
 - 3.3.1 Activity Time Estimate
 - 3.3.2 Event Times by Forward & Backward Pass Calculation
 - 3.3.3 Start and Finish Time of Activity
 - 3.3.4 Project Duration
 - 3.3.5 Floats, Types of Floats
 - 3.3.5.1 Free
 - 3.3.5.2 Independent
 - 3.3.5.3 Total Floats
 - 3.3.6 Critical Activities and Critical Path
- 3.4 Purpose of Crashing a Network
 - 3.4.1 Normal Time and Cost
 - 3.4.2 Crash Time and Cost
 - 3.4.3 Cost Slope
 - 3.4.4 Optimization of Cost and Duration
- 3.5 Material Management
 - 3.5.1 Ordering Cost
 - 3.5.2 Inventory Carrying Cost
 - 3.5.3 Economic Order Quantity
- 3.6 Store Management
 - 3.6.1 Various Records related to Store Management
 - 3.6.2 Inventory Control by ABC Technique
 - 3.6.3 Introduction to Material Procurement through Portals (e.g. www.inampro.nic.in)
- 4 Construction Contracts and Specifications**
 - 4.1 Types of Construction Contracts
 - 4.2 Contract documents
 - 4.2.1 Specifications
 - 4.2.2 General Special Conditions
 - 4.3 Contract Management
 - 4.4 Procedures involved in Arbitration and Settlement (Introduction only)
- 5 Safety in Construction**
 - 3.1 Safety in Construction Industry
 - 3.1.1 Causes of Accidents
 - 3.1.2 Remedial and Preventive Measures
 - 3.2 Labour Laws and Acts pertaining to Civil construction activities (Introduction only)

SUGGESTED LEARNING RESOURCES

1. Sharma S C and Deodhar S V, Construction Engineering and Management, Khanna Book Publishing, New Delhi
2. Gahlot, P.S. and Dhir, B.M Construction planning and management New Age International (P) Ltd. Publishers, New Delhi.
3. Shrivastava, U.K., Construction planning and management, Galgotia Publication Pvt Ltd. New Delhi
4. Mantri, S., The A To Z of Practical Building Construction and its Management, Satya Prakashan New Delhi
5. Khanna, O.P. , Industrial Engineering and management, Dhanpat Rai New Delhi
6. Punmia, B.C. and Khandelwal, K.K., Project Planning and Controlling with PERT And CPM, Laxmi Publications (P)Ltd.
7. Sengupta, B., Guha H., Construction Management and Planning, Tata-McGraw Hill.
8. Harpal, Singh, Construction Management and accounts, Mc-Graw Hill.
9. Sharma, S.C., Industrial Engineering and Management, Khanna Publications, New Delhi

RURAL CONSTRUCTION TECHNOLOGY

Course Code	CE 40072 (Same as CC 40072)
Course Title	Rural Construction Technology
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

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.

COURSE OUTCOMES

After completing this course, student will be able to:

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

COURSE CONTENTS**1. Rural Development and Planning**

- 1.1 Scope
- 1.2 Development Plans
- 1.3 Various approaches to Rural Development Planning
- 1.4 Significance of Rural Development
- 1.5 Rural development programme/projects

2. Rural Housing

- 2.1 Low cost construction material for housing
- 2.2 Composite material
 - 2.2.1 Ferro-cement & Fly Ash
 - 2.2.2 Autoclaved Calcium Silicate Bricks
 - 2.2.3 Soil-Stabilized un-burnt Brick
- 2.3 Plinth Protection of Mud Walls
- 2.4 Water-Proof and Fire-retardant Roof Treatment for Thatch Roofs
- 2.5 Pre-cast Stone Masonry
- 2.6 Rat-trap Bond for Walls
- 2.7 Panels for Roof
- 2.8 Ferro-Cement Flooring/Roofing units
- 2.9 Biomass - Types of fuels such as
 - 2.9.1 Firewood
 - 2.9.2 Agricultural Residues
 - 2.9.3 Dung Cakes
- 2.10 Renewable Energy and Integrated Rural Energy Program
 - 2.10.1 Objectives
 - 2.10.2 Key elements
 - 2.10.3 Implementation
 - 2.10.4 Financial Provisions
 - 2.10.5 Sources of Renewable Energy
- 2.11 Working of Gobar Gas and Bio Gas Plants.

3. Water Supply and Sanitation for Rural Areas

- 3.1 Sources of Water: BIS & WHO Water Standards.
- 3.2 Quality, Storage and Distribution for Rural Water Supply Works

- 3.3 Hand Pumps
 - 3.3.1 Types
 - 3.3.2 Installation
 - 3.3.3 Operation
 - 3.3.4 Maintenance of Hand Pumps
- 3.4 Conservation of water
 - 3.4.1 Rainwater Harvesting
 - 3.4.2 Drainage in Rural Areas
- 3.5 Construction of Low Cost Latrines
 - 3.5.1 Two Pit Pour Flush Water Seal
 - 3.5.2 Septic Tank etc.
- 3.6 Low Cost Community and Individual Garbage Disposal Systems
- 3.7 Ferro-Cement Storage Tanks

4. Low Cost Rural Roads

- 4.1 Broad categories of Pavement Layers
- 4.2 Types of Granular Sub-Bases and Bases
- 4.3 Guidelines for Surfacing of Rural Road as per relevant IRC codes
- 4.4 Pradhan Mantri Gram Sadak Yojna (PMGSY) - Highlights of Scheme

5. Low Cost Irrigation

- 5.1 Design consideration and construction of
 - 5.1.1 Tube-Well
 - 5.1.2 Drip Irrigation System
 - 5.1.3 Sprinkler Irrigation System
- 5.2 Watershed and Catchment Area Development – Problems and Features of Watershed Management
- 5.3 Watershed Management Structures
 - 5.3.1 K. T. Weir
 - 5.3.2 Gabion Structure
 - 5.3.3 Cement Plug
 - 5.3.4 Contour Bunding
 - 5.3.5 Farm Pond
 - 5.3.6 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 Construction.
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.

HYDRAULICS LAB

Course Code	CE 4008(Same as CC/CV 4008)
Course Title	Hydraulics Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

Course Outcomes

After completing this course, student will be able to:

1. Measure pressure and determine total hydrostatic pressure for different conditions.
2. Understand various parameters associated with fluid flow.
3. Determine head loss of fluid flow through pipes.
4. Find the fluid flow parameters in open channels.
5. Select relevant hydraulic pumps for different applications.

LIST OF PRACTICALS TO BE PERFORMED

1.	Use Piezometer to measure Pressure at a given point.
2.	Use U tube Differential Manometer to measure Pressure Difference between two given points.
3.	Use Reynold's Apparatus to determine type of flow.
4.	Use Bernoulli's Apparatus to apply Bernoulli's Theorem to get Total Energy Line for a flow in a closed conduit of varying cross sections.
5.	Use Friction Factor Apparatus to determine Friction Factor for a given pipe.
6.	Determine Minor Losses in pipe fittings due to Sudden Contraction and Sudden Enlargement.
7.	Determine Minor Losses in pipe fitting due to Bend and Elbow.
8.	Calibrate Venturimeter to find out the discharge in a pipe.
9.	Calibrate the Orifice to find out the discharge through a tank.
10.	Use Current meter to measure the velocity of flow of water in Open Channel.
11.	Use Pitot Tube to measure the velocity of flow of water in Open Channel.
12.	Use Triangular Notch to measure the discharge through Open Channel.
13.	Use Rectangular Notch to measure the discharge through Open Channel.

SUGGESTED LEARNING RESOURCES

1. Modi,P.N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics and Hydraulic Machines, Khanna Publishing House, Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Company, New Delhi.
4. Khurmi,R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S Chand Publishers, New Delhi.
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

ADVANCED SURVEYING LAB

Course Code	CE 4009 (Same as CC 4009)
Course Title	Advanced Surveying Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To know methods of plane surveying, Theodolite surveying and their uses.
- To learn tacheometric surveying and curve setting.
- To understand the principles of Electronic Distance Measurement and Total station and their uses.
- To know the concept of Remote Sensing, GPS and GIS.

Course Outcomes

After completing this course, student will be able to:

1. Prepare plans using Plane Table Surveys.
2. Prepare plans using Theodolite surveys.
3. Find distances and elevations using Tachometer.
4. Make measurements using Total Station.

LIST OF PRACTICALS TO BE PERFORMED

1.	Use Plane Table Survey to prepare plans of a plot of seven sided closed traverse by Radiation Method.
2.	Use Plane Table Survey to prepare plans, locate details by Intersection Method.
3.	Use Plane Table Survey to prepare plans, locate details by Traversing Method.
4.	Use Plane Table Survey to carry out Survey Project for closed traverse for minimum five sides around a building.
5.	Use Transit Theodolite to measure Horizontal and Vertical angle by Direct Method.
6.	Running a closed traverse using theodolite, computation, balancing and plotting by Gale's traverse table
7.	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Theodolite Survey Project.
8.	Use Theodolite as a Tacheometer to compute reduced levels and horizontal distances.
9.	Set out a circular curve by Rankine's Method of Deflection Angles.
10.	Use micro optic Theodolite to Measure Horizontal angle by Direct Method.
11.	Use EDM to measure horizontal distance.
12.	Use Total station instrument to measure horizontal distances
13.	Use Total station instrument to measure vertical angle.
14.	Use Total station instrument to carry out Survey Project for closed traverse for minimum five sides.
15.	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Total Station Survey Project.
16.	Use GPS to locate the coordinates of a station.

SUGGESTED LEARNING RESOURCES

1. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling Part I and II, Pune Vidyarthi GruhPrakashan, 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. Venkatramiah, 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. De, Alak, Plane Surveying, S.Chand Publications, New Delhi.

BUILDING PLANNING AND DRAWING LAB

Course Code	CE 4010 (Same as CC/CV 4010)
Course Title	Building Planning and Drawing Lab
Number of Credits	2 (L: 0, T: 0, P: 4)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the basic principles of building planning and drawing.
- To make graphical representation of various components of buildings.
- To draw complete plan and elevation of a building.
- To learn basics of perspective drawings and Computer Aided Drawings.

LIST OF PRACTICALS / DRAWINGS TO BE COMPLETED

A. Sketch Book	
1.	Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962
2.	Write summary of observations of all technical details from the given drawing (One/Two BHK) obtained from the professional architect or civil engineer (Group activity in four students).
3.	a) Measure the units of existing building (Load Bearing / Frame structure). b) Draw Line Plan of measured existing building at serial no 3a to the suitable scale.
4.	Draw Line Plan to suitable scale (Minimum 1BHK, Staircase, WC and Bathroom) a) Residential Bunglows(Minimum three plans) b) Apartment (Minimum two plans).
5.	Draw line plans to suitable scale for any Five Public Buildings from the following (School Building, Primary Health Centre, Bank, Post Office, Hostel, Restaurant, Community Hall and Library)
6.	Draw the following plans for a Framed Structure (One/Two BHK) from given line plan. a) Developed plan, Elevation b) Section for above developed plan. c) Site plan for above drawings including area statement, schedule of opening and construction notes
B. Full Imperial Size Sheet (A1)	
1.	Draw submission drawing to the scale 1:100 of a single storey load bearing residential building (2BHK) with flat Roof and staircase showing a) Developed plan and elevation b) Section passing through Stair or W.C. and Bath c) Foundation plan and schedule of openings d) Site plan (1:200), area statement, construction notes
2.	Draw submission drawing, to the scale of 1:100, of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing: a) Developed plan b) Elevation c) Section passing through Staircase, WC and Bath d) Site plan (1:200) and area statement e) Schedule of openings and Construction Notes.
3.	Draw the above mentioned drawing at serial number (B-2) using CAD software and enclose the print out. a) Developed plan b) Elevation. c) Section passing through Staircase, WC and Bath d) Foundation plan e) Site plan (1:200), area statement, Schedule of openings and construction notes.
4.	Draw working drawing for above mentioned drawing at serial number (B-2) showing

	a) Foundation plan to the scale 1:50 b) Detailed enlarged section of RCC column and footing with plinth filling c) Detailed enlarged section of RCC Beam, Lintel and Chajjas d) Detailed enlarged section of RCC staircase and slab
5.	Draw two point perspective drawing of small simple objects ,scale 1:50 a) Draw plan, elevation, eye level, picture plane and vanishing points. b) Draw perspective view

SUGGESTED LEARNING RESOURCES

1. Shah. M.G. Kale, CM, Patki, S.Y., Building Drawing, Mcgraw Hill Publishing
2. Malik and Mayo, Civil Engineering Drawing, Computech Publication Ltd
3. M. G. Shah and C. M. Kale, Principles of Perspective Drawing, Mcgraw Hill
4. Swamy, Kumara; Rao, N, Kameshwara, A ., Building Planning and Drawing, Charotar Publication, Anand.
5. Bhavikatti, S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
6. Mantri, Sandip, A to Z Building Construction, Satya Prakashan, New Delhi.
7. Singh, Ajit, Working with Auto CAD 2000, Mcgraw Hill Publishing company Ltd.
8. Sane, Y.S., Planning and design of Building, Allied Publishers, New Delhi.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Interpret the symbols, signs and conventions from the given drawing.
2. Prepare line plans of residential and public buildings using principles of planning.
3. Prepare working drawing for the given requirement of Load Bearing Structure.
4. Prepare working drawing using CAD for the given requirement of Framed Structure.
5. Draw two-point perspective drawing for given small objects.

(SEMESTER SCHEME-2020-21)

WATER RESOURCES ENGINEERING LAB

Course Code	CE 4011
Course Title	Water Resources Engineering Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn estimation of hydrological parameters.
- To understand water demand of crops and provisions to meet the same.
- To know planning of reservoirs and dams.
- To design irrigation projects, canals and other diversion works.

LIST OF PRACTICALS TO BE PERFORMED

1.	Calculate average rainfall for the given area using arithmetic mean method.
2.	Calculate average rainfall for the given area using Isohyetal, Theissen polygon method.
3.	Compute the yield of the Catchment area demarcated in Sr.No.2 .
4.	Estimate crop water requirement for the given data.
5.	Estimate capacity of the canal for the given data.
6.	Calculate reservoir capacity from the given data.
7.	Calculate control levels for the given data for a given reservoir.
8.	Draw a labeled sketch of the given masonry/earthen dam section.
9.	Prepare a model of any irrigation structure using suitable material.
10.	Draw a labeled sketch of the given diversion head works and Cross Drainage works.
11.	Design a canal section for the given conditions with estimation of the quantity of material required for lining.

SUGGESTED LEARNING RESOURCES

1. Punmia, B.C., Pande, B, Lal, Irrigation and water power engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. Mutreja K N, Applied Hydrology, McGraw Hill
4. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand and Company
5. Basak, N.N., Irrigation Engineering, McGraw Hill Education India Pvt. Ltd.
6. Asawa, G.L., Irrigation and water resource Engineering, New Age International(P)
7. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
8. Garg, S K, Irrigation and Hydraulic structures, Khanna Publishers, Delhi.
9. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Estimate hydrological parameters.
2. Estimate crop water requirements of a command area and capacity of canals.
3. Execute Minor and Micro Irrigation Schemes.
4. Select relevant Cross Drainage works for the specific site conditions.
5. Design, construct and maintain simple irrigation regulatory structures.

TRANSPORTATION ENGINEERING LAB

Course Code	CE 4012 (Same as CC 4012)
Course Title	Transportation Engineering Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To identify the types of roads as per IRC recommendations.
- To understand the geometrical design features of different highways.
- To perform different tests on road materials.
- To identify the components of railway tracks.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Identify the types of roads as per IRC recommendations.
2. Implement the geometrical design features of different highways.
3. Perform different Tests on road materials.
4. Identify the components of railway tracks.
5. Identify the defects in railway tracks.

LIST OF PRACTICALS TO BE PERFORMED:

1.	Draw the sketches showing standard cross sections of Expressways, Freeways, NH/SH, MDR/ODR.
2.	Flakiness and Elongation Index of Aggregates.
3.	CBR Test.
4.	Aggregate Impact Test.
5.	Los Angeles Abrasion Test.
6.	Aggregate Crushing Test.
7.	Softening Point Test of Bitumen.
8.	Penetration Test of Bitumen.
9.	Flash and Fire Point Test of Bitumen.
10.	Ductility Test of Bitumen.
11.	Visit the constructed road for visual inspection to identify defects and suggest remedial measures.
12.	Visit the road of any one type (flexible or rigid) to know the Drainage Condition.
13.	Visit to Railway Track for visual inspection of fixtures, fasteners and yards.

SUGGESTED LEARNING RESOURCES

1. L.R. Kadiyali, Transportation Engineering, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-82609-858) Edition 2018
2. Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering, Nem Chand and Brothers, Roorkee.
3. Arora, N. L., Transportation Engineering, Khanna Publishers, Delhi.
4. Saxena S C and Arora S P, A Textbook of Railway Engineering, Dhanpat Rai Publication.
5. Birdi, Ahuja, Road, Railways, Bridge and Tunnel Engg ,Standard Book House, Delhi.
6. Sharma, S.K., Principles, Practice and Design of Highway Engineering,, S. Chand
7. Duggal, Ajay K. and Puri, V. P., Laboratory Manual in Highway Engineering,New Age International (P) Limited, Publishers, New Delhi.
8. Subramanian, K.P., Highway, Railway, Airport and Harbour Engineering, Scitech Publications, Hyderabad.

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR
SEMESTER SCHEME-2020-21



V SEMESTER
(SESSION 2021-2022 & ONWARDS)

DESIGN OF STEEL AND RCC STRUCTURES

Course Code	CE 5001 (Same as CC 5001)
Course Title	Design of Steel and RCC Structures
Number of Credits	4 (L: 4, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the concept of limit state design for tension and compression steel members.
- To learn the concept of limit state design of steel beams.
- To understand design of RCC elements.
- To know the design of short and long RCC columns.

COURSE OUTCOMES

After completing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel I and Channel sections.
- Design of singly and doubly reinforced RCC beam.
- Design of RCC beam for shear and development length.
- Design of short and long RCC columns.

COURSE CONTENT**1. Design of Steel Tension and Compression Members (Limit State Method)**

- 1.1 Types of sections used for Tension members.
- 1.2 Introduction to Strength of tension member by- yielding of section, rupture of net cross-section and block shear.
- 1.3 Design of axially loaded single angle and double angle tension members with bolted and welded connections.
- 1.4 Types of sections used as compression member, Calculation of effective length, Radius of gyration and slenderness ratio, Permissible values of slenderness ratio as per IS 800, Design compressive stress.
- 1.5 Introduction to built up sections, lacing and battening (Meaning and purpose), Diagrams of single and double lacing and battening system. (No numerical problems).
- 1.6 Design of axially loaded single and double angle struts connected by bolted and welded connections with gusset plate.

2. Design of Steel beams (Limit State Method)

- 2.1 Standard beam sections, Bending stress calculations
- 2.2 Design of laterally restrained simple I section beams
- 2.3 Check for shear and deflection as per IS 800.

3. Design of Reinforced Concrete Beams by Limit State Method

- 3.1 Concept of Limit state, Stress block diagram, Introduction to singly and doubly reinforced sections, IS 456
- 3.2 Design of singly reinforced beam, concept of under reinforced, over reinforced and balanced section, Simple numerical problem on ultimate moment of resistance and design of beam section
- 3.3 Design of doubly reinforced sections, stress and strain diagrams, depth of neutral axis, simple numerical problems on ultimate moment of resistance of reinforced beam, Calculation of A_{st} and A_{sc} .

4. Shear, Bond and Development length in Design of RCC member

- 4.1 Nominal shear stress in RCC section, Design shear strength of concrete, Design of shear reinforcement, Minimum Shear Reinforcement, Provisions of IS 456, forms of shear reinforcement
- 4.2 Types of bond, Bond stress, check for bond stress, Determination of Development length in tension and compression members and check as per codal provisions, Anchorage value of 90° hook, Lapping of bars.
- 4.3 Simple numerical problem on: Shear reinforcement, Adequacy of section for shear.
- 4.4 Introduction to serviceability limit state check

5. Design of axially loaded RCC Column

- 5.1 Definition and classification of column, Limit state of compression members, Effective length of column.
- 5.2 Provisions of IS 456 for minimum steel, cover, maximum steel, spacing of ties etc.
- 5.3 Design of axially loaded short column - Square, Rectangular, and Circular only.

SUGGESTED LEARNING RESOURCES

1. Shah, V. L., and Gore, V., Limit State Design of Steel Structures, Structures Publications, Pune.
2. Dayarathnam P., Design of Steel Structures, S. Chand and Company, Delhi.
3. Subramanian N., Design of Steel Structures, Oxford University Press.
4. Sairam, K.S., Design of Steel Structures, Pearson Publication, Chennai, Delhi.
5. Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune,2014.
6. Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
7. Krishna Raju, and N. Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
8. Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
9. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

SEMESTER SCHEME 2020-21

ESTIMATING , COSTING AND VALUATION

Course Code	CE 5002 (Same as CC/CV 5002)
Course Title	Estimating and Costing
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the procedure for estimating and costing of Civil Engineering works.
- To perform rate analysis for different items associated with construction projects.
- To use software for detailed estimate related to civil infrastructural projects.

COURSE OUTCOMES

After completing this course, student will be able to:

- Select modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Use relevant software for estimating the quantities and cost of items of works.
- Justify rate for given items of work using rate analysis techniques.

COURSE CONTENT**1. Fundamentals of Estimating and Costing**

1. Estimating and Costing –
 - 1.1.1 Meaning,
 - 1.1.2 Purpose
 - 1.1.3 Administrative approval
 - 1.1.4 Technical Sanction
 - 1.1.5 Budget provision
- 1.2 Types of estimates with definition & purpose
 - 1.2.1. Approximate estimate
 - 1.2.1 Detailed estimate
- 1.3 Types and Uses of Estimates:
 - 1.3.1 Revised estimate
 - 1.3.2 Supplementary estimate,
 - 1.3.3 Repair and maintenance estimate
 - 1.3.4 Renovation estimate.
- 1.4 Roles and responsibility of Estimator.
- 1.5 Checklist of items in load bearing and framed structure.
- 1.6 Standard formats of Measurement sheet, Abstract sheet, Face sheet.
- 1.7 Modes of measurement and desired accuracy in measurements for different items of work as per IS:1200.
- 1.8 Rules for deduction in different category of work as per IS:1200.
- 1.9 Description / specification of items of building work as per PWD /DSR.

2. Approximate Estimates

- 2.1 Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical bay method, Approximate quantity method (with simple numericals)

3. Detailed Estimate

- 3.1 Detailed Estimate-
 - 3.1.1 Data required for detailed estimate –
 - 3.1.1.1 Civil cost
 - 3.1.1.2 GST
 - 3.1.1.3 Contingencies
 - 3.1.1.4 Supervision charges

- 3.1.1.5 Agency charges
 - 3.1.1.6 Procedure for preparation of detailed estimate- Taking out quantities and Abstracting.
 - 3.2 Methods of Detailed Estimate-
 - 3.2.1 Unit quantity method
 - 3.2.2 Total quantity method
 - 3.2.3 Long wall and Short wall method, Centre line method.
 - 3.3 Bar bending schedule for footing, column, beam, Lintel, chajja and slab elements
 - 3.4 Provisions in detailed estimate: contingencies, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc.
 - 3.5 Prime cost, Provisional sum, Provisional quantities, Bill of quantities, Spot items or Site items.
- 4. Estimate for Civil Engineering Works**
- 4.1 Earthwork –
 - 4.1.1 Quantities for roads, Embankment and canal by
 - 4.1.1.1 Mid sectional area method, mean sectional area method
 - 4.1.1.2 Prismoidal and trapezoidal formula method.
 - 4.2 Detailed estimate for septic tank, Community well
 - 4.3 Introduction to use of computer /softwares / programmes for detailed estimate Preparation of Civil Engineering Works.
- 5. Rate Analysis**
- 5.1 Rate Analysis:
 - 1.1.1 Definition
 - 1.1.2 Purpose
 - 1.1.3 Importance
 - 5.2 Lead (Standard and Extra), lift, overhead charges, water charges and contractors' profit.
 - 5.3 Procedure for rate analysis.
 - 5.4 Task work- Definition, types. Task work of different skilled labour for different items.
 - 1.5 Categories of labours, their daily wages, types and number of labours for different items of work.
 - 5.5 Transportation charges of materials –
 - 5.5.1 Lead and Lift
 - 5.5.2 Hire charges of machineries and equipments
 - 5.6 Preparing rate analysis of different items of work pertaining to buildings and roads.

SUGGESTED LEARNING RESOURCES

1. Datta, B.N., Estimating and Costing in Civil engineering, UBS Publishers Distributors Pvt. Ltd. New Delhi.
2. Peurifoy, Robert L. Oberlender, Garold, Estimating construction cost (fifth edition), McGraw Hill Education,, New Delhi.
3. Rangwala, S.C., Estimating and Costing, Charotar Publishing House PVT. LTD., Anand.
4. Birdie, G.S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd. New Delhi.
5. Patil, B.S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai.
6. Chakraborti, M., Estimating and costing, specification and valuation in civil engineering, Monojit Chakraborti, Kolkata.
7. PWD Schedule of Rates.
8. Ministry of Road Transport and Highways (MORT&H) Specifications and Analysis of Schedule of Rates.
9. Manual of Specifications and Standards for DBFOT projects, EPC works.

ECONOMIC POLICIES IN INDIA

Course Code	CE 51001 (Same in All Branches of Engg.)
Course Title	Economic Policies in India
Number of Credits	3 (L:3, T:0, P:0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES:

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

CO1	Understand Indian economics policy, planning strategies
CO2	It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes
CO3	Development Economics as a discipline encompasses different approaches to the problems of unemployment, poverty, income generation, industrialization from different perspectives
CO4	Able to identify the problems and capable to decide the application for future development
CO5	Analyze economic issues and find solutions to complex economic problems and take correct economic judgment

COURSE CONTENTS:**1. BASIC FEATURES AND PROBLEMS OF INDIAN ECONOMY:**

- 1.1. Economic History of India;
- 1.2. Nature of Indian Economy
- 1.3. Demographic features and Human Development Index,
- 1.4. Problems of Poverty, Unemployment, Inflation, income inequality, Blackmoney in India.

2. SECTORAL COMPOSITION OF INDIAN ECONOMY:

- 2.1. Issues in Agriculture sector in India,
- 2.2. land reforms
- 2.3. Green Revolution
- 2.4. agriculture policies of India,
- 2.5.

3. INDUSTRIAL DEVELOPMENT,

- 3.1. Small scale and cottage industries,
- 3.2. Industrial Policy,
- 3.3. Public sector in India,
- 3.4. Service sector in India.

4. ECONOMIC POLICIES:

- 4.1. Economic Planning in India,
- 4.2. Planning commission v/s NITI Aayog,
- 4.3. Five Year Plans,
- 4.4. Monetary policy in India,
- 4.5. Fiscal Policy in India,
- 4.6. Centre state Finance Relations,
- 4.7. Finance commission in India
- 4.8. LPG policy in India

5. EXTERNAL SECTOR IN INDIA

- 5.1. India's foreign trade value composition and direction,
- 5.2. India Balance of payment since 1991,
- 5.3. FDI in India,

- 5.4. Impact of Globalization on Indian Economy,
- 5.5. WTO and India.

REFERENCE BOOKS:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy .S Chand & Co.Ltd. New Delhi.
2. Mishra S. K & V. K Puri (2017). Indian Economy and Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, NewDelhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India ,Oxford University Press.

SEMESTER SCHEME 2020-21

ENGINEERING ECONOMICS & ACCOUNTANCY

Course Code	CE 51002 (Same in All Branches of Engg.)
Course Title	Engineering Economics & Accountancy
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

COURSE OBJECTIVES

- To acquire knowledge of basic economicst of a cilitate the process of economic decision making.
- To acquire knowledge on basic financial management aspects.
- To develop the basic skills to analyze financial statements.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the macro-economic environment of the business and its impact on enterprise
CO2	Understand cost elements of the product and its effect on decision making
CO3	Prepare accounting records and summarize and interpret the accounting datafor managerial decisions
CO4	Understand accounting systems and analyze financial statements using ratio analysis
CO5	Understand the concepts of financial management and investment

COURSE CONTENTS**1. INTRODUCTION:**

- 1.1. Managerial Economics;
- 1.2. Relationship with other disciplines;
- 1.3. Firms: Types, objectives and goals;
- 1.4. Managerial decisions;
- 1.5. Decision analysis.

2. DEMAND & SUPPLY ANALYSIS:

- 2.1. Demand;
 - 2.1.1. Types of demand;
 - 2.1.2. Determinants of demand;
 - 2.1.3. Demand function;
 - 2.1.4. Demand elasticity;
 - 2.1.5. Demand forecasting;
- 2.2. Supply;
 - 2.2.1. Determinants of supply;
 - 2.2.2. Supply function;
 - 2.2.3. Supply elasticity.

3. PRODUCTION AND COST ANALYSIS:

- 3.1. Production function;
- 3.2. Returns to scale;
- 3.3. Production optimization;
- 3.4. Least cost input; Iso quants;
- 3.5. Managerial uses of production function;
- 3.6. Cost Concepts;
 - 3.6.1. Cost function;
 - 3.6.2. Types of Cost;
 - 3.6.3. Determinants of cost;
 - 3.6.4. Short run and Long run cost curves;
 - 3.6.5. Cost Output Decision;
 - 3.6.6. Estimation of Cost.

4. PRICING:

- 4.1. Determinants of Price;
- 4.2. Pricing under different objectives and different market structures;
- 4.3. Price discrimination;
- 4.4. Pricing methods in practice;
- 4.5. Role of Government in pricing control.

5. FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT):

- 5.1. Balance sheet and related concepts;
- 5.2. Profit & Loss Statement and related concepts;
- 5.3. Financial Ratio Analysis;
- 5.4. Cash flow analysis;
- 5.5. Funds flow analysis;
- 5.6. Comparative financial statements;
- 5.7. Analysis & Interpretation of financial statements;
- 5.8. Investments;
- 5.9. Risks and return evaluation of investment decision;
- 5.10. Average rate of return;
- 5.11. Payback Period;
- 5.12. Net Present Value;
- 5.13. Internal rate of return,

REFERENCE BOOKS:

- 1. Mc Guigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.
- 2. Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition, 2005.
- 3. Samuelson. Paul A and Nordhaus W. D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
- 4. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.
- 5. Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson SouthWestern, 4th Edition, 2001.

SOLID WASTE MANAGEMENT

Course Code	CE 50031
Course Title	Solid Waste Management
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To know various sources of solid.
- To learn techniques of collection and transportation of solid waste.
- To know various methods of disposal of solid waste.
- To understand and identify different biomedical and E-waste and their subsequent disposal techniques.

COURSE OUTCOMES

After completing this course, student will be able to:

- Identify the sources of solid waste.
- Select the relevant method of collection and transportation of solid waste.
- Suggest an action plan for composting of solid waste.
- Devise suitable disposal technique for solid waste
- Use the relevant method for disposal of Bio-medical and E-waste.

COURSE CONTENT**1. Introduction**

- 1.1 Definition of solid waste
- 1.2 Different solid waste
 - 1.2.1 Domestic Waste
 - 1.2.2 Commercial waste
 - 1.2.3 Industrial waste
 - 1.2.4 Market waste
 - 1.2.5 Agricultural waste
 - 1.2.6 Biomedical waste
 - 1.2.7 E-waste, hazardous waste
 - 1.2.8 Institutional waste
- 1.3 Sources of solid waste
 - 1.3.1 Classification of solid waste
 - 1.3.1.1 Hazardous
 - 1.3.1.2 Non hazardous waste.
- 1.4 Physical and chemical characteristics of municipal solid waste.

2. Storage, Collection and Transportation of Municipal Solid Waste

- 2.1 Collection, segregation, storage and transportation of solid waste.
- 2.2 Tools and Equipment-
 - 2.2.1 Litter Bin
 - 2.2.2 Broom, Shovels
 - 2.2.3 Handcarts
 - 2.2.4 Mechanical road sweepers
 - 2.2.5 Community bin
 - 2.2.5.1 Movable
 - 2.2.5.2 Stationary bin
- 2.3 Transportation vehicles with their working capacity
 - 2.3.1 Animal carts
 - 2.3.2 Auto vehicles
 - 2.3.3 Tractors or Trailers
 - 2.3.4 Trucks, Dumpers

2.3.5 Compactor vehicles

2.3.6 Transfer station

2.3.6.1 Meaning

2.3.6.2 Necessity

2.3.6.3 Location.

2.4 Role of rag pickers and their utility for society

3. Composting of Solid Waste

3.1 Concept of composting of waste, Principles of composting process. Factors affecting the composting process.

3.2 Methods of composting

3.2.1 Manual Composting

3.2.1.1 Bangalore method

3.2.1.2 Indore Method

3.2.2 Mechanical Composting

3.2.2.1 Dano Process

3.2.2.2 Vermi composting

4. Techniques for Disposal of Solid Waste

4.1 Solid waste management techniques

4.1.1 solid waste management hierarch

4.1.2 waste prevention

4.1.3 waste reduction techniques

4.2 Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste

4.3 Incineration of waste: Introduction of incineration process,

4.3.1 Types of incinerators –

4.3.1.1 Flash,

4.3.1.2 Multiple chamber Incinerators,

4.3.2 Products of incineration process with their use,

4.3.2.1 Pyrolysis of waste

4.3.2.1.1 Definition

4.3.2.1.2 Methods

5 Biomedical and E-waste management

1.1 Definition of Bio medical Waste.

1.2 Sources and generation of Biomedical Waste and its classification

1.3 Bio medical waste Management technologies.

1.4 Definition, varieties and ill effects of E- waste,

1.5 Recycling and disposal of E- waste.

SUGGESTED LEARNING RESOURCES

1. Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co., Delhi Ed. 2018
2. Bhide, A. D., Solid Waste Management, Indian National Scientific Documentation Centre, New Delhi.
3. George Techobanoglous, Kreith, Frank., Solid Waste, McGraw Hill Publication, New Delhi.
4. Sasikumar, K., Solid Waste Management, PHI learning, Delhi.
5. Hosetti, B.B., Prospect and Perspectives of Solid Waste Management, New Age International Publisher.

BUILDING SERVICES AND MAINTENANCE

Course Code	CE 50032 (Same as CC 50032)
Course Title	Building Services and Maintenance
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To know the procedure for classifying various types of building services.
- To know the fire safety requirements for multi-storeyed building.
- To devise suitable plumbing system for given type of building.
- To understand the procedure for rain water harvesting and solar water heater.
- To know the system for designing lighting, ventilation and acoustics for any building.

COURSE OUTCOMES

After completing this course, student will be able to:

- Classify various types of building services as per functional requirements.
- Propose the fire safety requirements for multi-storeyed building.
- Devise suitable water supply and sanitation system for given type of building.
- Evaluate the potential of rain water harvesting and solar water heater system for the given type of building.
- Justify the necessity of designing the system of lighting, ventilation and acoustics for the given type of building.

COURSE CONTENT**1. Overview of Building Services**

- 1.1 Introduction to building services,
- 1.2 Classification of buildings as per National Building code
- 1.3 Necessity of building services
- 1.4 Functional requirements of building, Different types of building services i.e. HVAC (Heat, Ventilation and Air Conditioning)
- 1.5 Escalators and lifts
- 1.6 Fire safety
- 1.7 Protection and control
- 1.8 Plumbing services
- 1.9 Rain water harvesting
- 1.10 Solar water heating system
- 1.11 Lighting, acoustics,
- 1.12 Sound insulation and electric installation etc.
- 1.13 Role and responsibility of Building Service Engineer,
- 1.14 Introduction to BMS (Building Management Services)
- 1.15 Role of BMS, concept of smart building

2. Modes of vertical communication

- 2.1 Objectives and modes of vertical communication in building.
- 2.2 Lifts
 - 2.2.1 Different types of lifts and its uses
 - 2.2.2 Component parts of Lift-
 - 2.2.2.1 Lift Well
 - 2.2.2.2 Travel
 - 2.2.2.3 Pit, Hoist Way
 - 2.2.2.4 Machine, Buffer
 - 2.2.2.5 Door Locks
 - 2.2.2.6 Suspended Rope

- 2.2.2.7 Lift Car
- 2.2.2.8 Landing Door
- 2.2.2.9 Call Indicators
- 2.2.2.10 Call Push etc
- 2.2.3 Design provisions for basic size calculation of space enclosure to accommodate lift services, Safety measures.
- 2.3 Escalators
 - 2.3.1 Different Types of Escalators and its Uses
 - 2.3.2 Components of escalators
 - 2.3.3 Design provisions for basic size calculation of space enclosure to accommodate escalator services, Safety measures.
- 2.4 Ramp
 - 2.4.1 Necessity
 - 2.4.2 Design consideration
 - 2.4.3 Gradient calculation
 - 2.4.4 Layout and Special features required for physically handicapped and elderly
- 3. Fire Safety**
 - 3.1 Fire protection requirements for multi-storeyed building
 - 3.2 Causes of fire in building
 - 3.3 Fire detecting and various extinguishing systems
 - 3.4 Working principles of various fire protection systems
 - 3.5 Safety against fire in residential and public buildings (multi-storeyed building)
 - 3.6 National Building Code provision for fire safety
 - 3.7 Fire resisting materials and their properties
 - 3.8 Fire resistant construction
 - 3.9 Procedures for carrying out fire safety inspections of existing buildings
 - 3.10 Provisions for evacuation
- 4. Plumbing Services**
 - 4.1 Importance of plumbing
 - 4.2 AHJ (Authority Having Jurisdiction) approval
 - 4.3 Plumbing Terminology and fixtures: Terms used in plumbing, Different types of plumbing fixtures, shapes/ sizes, capacities, situation and usage, Traps, Interceptors.
 - 4.4 System of plumbing for building water supply: storage of water, hot and cold water supply system.
 - 4.5 System of plumbing for building drainage: Types of drainage system such as two pipe system, one pipe system, types of Vents and purpose of venting, Concept of grey water and reclaimed water.
 - 4.6 Different pipe materials, and jointing methods, fittings, hanger, supports and valves used in plumbing and their suitability.
- 5. Lighting, Ventilation and Acoustics**
 - 5.1 Concept of SWH (Solar water heating), component parts of SWH, various system of SWH (heat transfer, propulsion, passive direct system, active direct system, Do-it-yourself), installation and maintenance
 - 5.2 Concept of lighting, types of lighting (natural and artificial), factors influencing the brightness of room, factors affecting selection of artificial lighting, installation of light (direct, half-direct, indirect, half-indirect and direct-indirect), types of light control (manual switch, remote switch, timer switch and photo-electric cell switch)
 - 5.3 Types of lamps (incandescent, tungsten halogen and electric discharge), Lamp selection as per room sizes
 - 5.4 Concept of ventilation, necessity and Types of ventilation
 - 5.5 Building Acoustic, Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator)

SUGGESTED LEARNING RESOURCES

1. Patil, S. M., Building Services, Seema Publication, Mumbai.
2. Mantri and Sandeep., The A to Z of Practical Building Construction and its Management, Satya Prakashan, New Delhi.
3. Bag S P, Fire Services in India: History, Detection, Protection, Management, Mittal Publications, New Delhi.
4. Deolalikar,S. G., Plumbing Design and Practice, McGraw-Hill,
5. Akhil Kumar Das., Principles of Fire Safety Engineering: Understanding Fire and Fire Protection, PHI Learning Pvt. Ltd, New Delhi.
6. Shraman N L, Solar panel installation guide & user manual,The Memory Guru of India.
7. Gupta M K, Practical handbook on building maintenance - Civil works, Nabhi Publications.
8. BIS., National Building Code Part1, 4, 8, 9., Bureau of Indian Standard, New Delhi
9. BIS., IS 12183(Part 1):1987 Code of practice for plumbing in multistoried buildings., Bureau of Indian Standard, New Delhi
10. BIS., 2008 Uniform plumbing code – India (UPC-I)., Bureau of Indian Standard

SEMESTER SCHEME 2020-21

GREEN BUILDING AND ENERGY CONSERVATION

Course Code	:	CE 50041 Same as AR/CC/CV 50041
Course Title	:	Green Building and Energy Conservation
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To know various aspects of green buildings
- To use different steps involved in measuring environmental impact assessment.
- To relate the construction of green building with prevailing energy conservation policy and regulations.
- To know and identify different green building construction materials.
- To learn different rating systems and their criteria.

COURSE OUTCOMES

After completing this course, student will be able to:

- Identify various requirements for green building.
- Use different steps in environmental impact assessment.
- Relate the construction of green building with prevailing energy conservation policy and regulations.
- Supervise the construction of green building construction using green materials.
- Focus on criteria related to particular rating system for assessment of particular Green building.

COURSE CONTENT**1. Introduction to Green Building and Design Features**

- 1.1 Definition of Green Building, Benefits of Green building, Components/features of Green Building, Site selection, Energy Efficiency, Water efficiency, Material Efficiency, Indoor Air Quality.
- 1.2 Site selection strategies, Landscaping, building form, orientation, building envelope and fenestration, material and construction techniques, roofs, walls, fenestration and shaded finishes, advanced passive heating and cooling techniques, waste reduction during construction

2. Energy Audit and Environmental Impact Assessment (EIA)

- 2.1 Energy Audit:
 - 2.1.1 Meaning
 - 2.1.2 Necessity
 - 2.1.3 Procedures
 - 2.1.4 Types,
 - 2.1.5 Energy Management Programs
- 2.2 Environmental Impact Assessment(EIA):
 - 2.2.1 Introduction
 - 2.2.2 EIA regulations
 - 2.2.3 Steps in environmental impact assessment process
 - 2.2.4 Benefits of EIA
 - 2.2.5 Limitations of EIA
 - 2.2.6 Environmental clearance for the civil engineering projects

3. Energy and Energy conservation

- 3.1 Renewable Energy Resources:
 - 3.1.1 Solar Energy
 - 3.1.2 Wind Energy
 - 3.1.3 Ocean Energy
 - 3.1.4 Hydro Energy
 - 3.1.5 Biomass Energy
- 3.2 Non-renewable Energy Resources:
 - 3.2.1 Coal,

- 3.2.2 Petroleum,
 - 3.2.3 Natural Gas,
 - 3.2.4 Nuclear Energy,
 - 3.2.5 Chemical Sources of Energy,
 - 3.2.6 Fuel Cells,
 - 3.2.7 Hydrogen,
 - 3.2.8 Biofuels.
- 3.3 Energy conservation:
- 3.3.1 Introduction, Specific objectives, present scenario, Need of energy conservation, LEED India Rating System and Energy Efficiency.
- 4. Green Building**
- 4.1 Principles
 - 4.1.1 Principles and planning of Green building
 - 4.2 Features
 - 4.2.1 Salient features of Green Building,
 - 4.2.2 Environmental design (ED) strategies for building construction.
 - 4.3 Process:
 - 4.4.1 Improvement in environmental quality in civil structure
 - 4.4 Materials:
 - 4.4.1 Green building materials and products
 - 4.4.1.1 Bamboo
 - 4.4.1.2 Rice husk ash concrete
 - 4.4.1.3 plastic bricks
 - 4.4.1.4 Bagasse particle board
 - 4.4.1.5 Insulated concrete forms
 - 4.4.2 reuse of waste material
 - 4.4.2.1 Plastic
 - 4.4.2.2 rubber
 - 4.4.2.3 Newspaper wood
 - 4.4.2.4 Nontoxic paint
 - 4.4.2.5 Green roofing
- 5. Rating System**
- 5.1 Introduction to(LEED) criteria.
 - 5.2 Indian Green Building council (IGBC) Green rating,
 - 5.3 Green Rating for Integrated Habitat Assessment. (GRIHA) criteria
 - 5.4 Heating Ventilation Air Conditioning (HVAC) unit in green Building
 - 5.5 Functions of Government organization working for Energy conservation and Audit(ECA)-
 - 5.6 National Productivity council(NPC)
 - 5.7 Ministry of New and Renewable Energy (MNRE)
 - 5.8 Bureau of Energy efficiency (BEE)

SUGGESTED LEARNING RESOURCES

1. Kibert, C.J., Sustainable construction: Green Building design and Delivery, John Wiley Hoboken, New Jersey.
2. Chauhan, D S Sreevasthava, S K., Non-conventional Energy Resources, New Age International Publishers, New Delhi.
3. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
4. Jagadeesh, K S, Reddy Venkatta Rama & Nanjunda Rao, K S., Alternative Building Materials and Technologies, New Age International Publishers, Delhi.
5. Sam Kubba., Handbook of Green Building Design and Construction, Butterworth-Heinemann.
6. Means R S, Green Building - Project Planning and Cost Estimating, John Wiley & Sons
7. Sharma K V, Venkataseshiah P., Energy Management and Conservation, IK International.

ADVANCED CONSTRUCTION TECHNOLOGY

Course Code	:	CE 50042 Same as AR 50042
Course Title	:	Advanced Construction Technology
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To gain knowledge on different materials in advanced construction
- To know different methods in concreting.
- To know the relevance of advanced construction methods for particular site condition.
- To identify the requisite hoisting and conveying machinery for the given situation.

COURSE OUTCOMES

After completing this course, student will be able to:

- Use relevant materials in advanced construction of structures.
- Use relevant method of concreting and equipment according to type of construction.
- Apply advanced construction methods for given site condition.
- Select suitable hoisting and conveying equipment for a given situation.
- Identify advanced equipment required for a particular site condition

COURSE CONTENT**1. Advanced Construction Materials**

- 1.1 Fibres: Use and properties of steel, polypropylene, carbon and glass fibres.
- 1.2 Plastics: Use and properties of PVC, RPVC, HDPE, FRP, GRP.
- 1.3 Miscellaneous Materials: Properties and uses of acoustics materials, wall claddings, plaster boards, micro-silica, waterproofing materials, adhesives.
- 1.4 Use of waste products and industrial byproducts in bricks, blocks, concrete and mortar.

2. Advanced Concreting Methods and Equipments

- 2.1 Ready Mix Concrete: Necessity and use of readymix concrete. Products and equipments for ready mix concrete plant. Conveying of ready mix concrete, transit mixers.
- 2.2 Vibrators for concrete consolidation: Internal, needle, surface, platform and form vibrators.
- 2.3 Underwater Concreting: Procedure and equipments required for Tremie method, Drop bucket method. Properties, workability and water cement ratio of the concrete.
- 2.4 Special concrete: procedure and uses of special concretes: Roller compacted concrete, Self-compacting concrete (SCC), Steel fibre reinforced concrete, Foam concrete, shotcreting.

3. Advanced Technology in Constructions

- 3.1 Construction of bridges and flyovers: Equipments and machineries required for foundation and super structure.
- 3.2 Construction of multi-storeyed Building: Equipments and machinery required for construction of multi-storeyed building such as use of lifts, belt conveyers, pumping of concrete.
- 3.3 Prefabricated construction: Methods of prefabrication, Plant fabrication and site fabrication, All prefabricated building elements such as wall panels, slab panels, beams, columns, door and window frames etc. Equipments and machineries used for placing and Jointing of prefabricated elements.
- 3.4 Strengthening of embankments by soil reinforcing techniques using geo-synthetics

4. Hoisting and Conveying Equipments

- 4.1 Hoisting Equipments: Derrick-Pole, Gin Pole, Crane, Power driven scotch derrick crane, Hand operated crane, Locomotive crane, Tower crane, Lattice Girder, Winches, Elevators, ladders. Crawler cranes, Truck mounted cranes, Gantry cranes, Mast cranes. (only introduction & uses)
- 4.2 Conveying Equipments: Working of belt conveyers, types of belts and conveying mechanism. Capacity and use of dumpers, tractors and trucks.

5 Miscellaneous Machineries and Equipments

- 5.1 Excavation Equipments: bull dozers, scrapers, graders, Clam Shell, trenching equipment, Tunnel boring machine, Wheel mounted belt loaders, power shovels, JCB, and drag lines. (only introduction & uses)
- 5.2 Compacting Equipments: different types of rollers such as plain rollers, ship footed rollers, vibratory, pneumatic rollers rammers.(only introduction & uses)
- 5.3 Miscellaneous Equipments: Working and selection of equipments: Pile driving equipments, Pile hammers, Hot mix bitumen plant, bitumen paver, grouting equipment, guniting equipments, floor polishing and cutting machine(only introduction & uses) selection of drilling pattern for blasting, Bentonite/mud slurry in drilling, Explosives for blasting, Dynamite, process of using explosives.

SUGGESTED LEARNING RESOURCES

1. Sharma S C and Deodhar S V, Construction Engineering and Management, Khanna Book Publishing, New Delhi
2. Chudly, R., Construction Technology Vol. I to II, ELBS-Longman Group.
3. Peurifoy, R. L., Construction Planning Equipment and Methods, McGraw Hill Co. Ltd, New York.
4. Seetharaman, S., Construction Engineering and Management, Umesh Publication, New Delhi.
5. Sengupta, B. and Guha., Construction Management and Planning, McGraw Hill Education, New Delhi.
6. Smith, R. C., Materials of Construction, McGraw Hill Co. Ltd.
7. Satyanarayana, R Saxena, S. C., Construction Planning and Equipment, Standard Publication, New Delhi.
8. Rangawala, S. C., Construction of Structures and Management of works, Charotar Publication, Anand.
9. Ghose, D. N., Materials of Construction, McGraw Hill Publishing Co, New Delhi.

SEMESTER SCHEME 2020-21

DESIGN OF STEEL AND RCC STRUCTURES LAB

Course Code	CE 50005 (Same as CC 5005)
Course Title	Design of Steel and RCC Structures Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the concept of limit state design of tension and compression steel members.
- To understand design of steel beams.
- To learn the concept of limit state design of RCC beams.
- To know the limit state design of RCC columns.

COURSE OUTCOMES

After completing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel beams including check for shear.
- Design of singly and doubly reinforced RCC beam.
- Design of shear reinforcement in RC beams.
- Design of RCC column as per IS 456.

LIST OF PRACTICAL TO BE PERFORMED

1	Draw any five commonly used rolled steel sections and five built up sections.
2	Summarize the provisions of IS 800 required for the design of tension member in report form.
3	Compile relevant clauses from IS 800 required for the design of a compression member and submit it in report form.
4	Draw sketches for single and double lacing of given built up columns.
5	Draw sketches for battening of given built up columns.
6	Prepare a report on the IS 800 provisions pertaining to design of lacing and battening along with its significance.
7	Draw cross section, strain diagram and stress diagram for singly reinforced section.
8	Draw cross section, strain diagram and stress diagram for doubly reinforced section.
9	Design simply supported I section steel beam for UDL.
10	Design beams section for shear as per IS 800 provisions.
11	Draw sketches of different types of column footings.
12	Interpret the actual RCC Structural Drawings used on site with reference to reinforcement details of various structural elements.
13	Prepare a checklist for reinforcement provided from actual drawings used on site for various structural elements.
14	Prepare a detailed report of site visit for reinforcement detailing of structural elements like beams, columns, staircase & footing.
15	Prepare a detailed report of site visit for study of rolled steel tension & compression members used in various structures.

SUGGESTED LEARNING RESOURCES

1. Shah, V. L., and Gore, V., Limit State Design of Steel Structures, Structures Publications, Pune.
2. Dayarathnam, P., Design of Steel Structures, S. Chand and Company, Delhi.
3. Subramanian N., Design of Steel Structures, Oxford University Press.
4. Sairam, K.S., Design of Steel Structures, Pearson Publication, Chennai, Delhi.

5. Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune,2014.
6. Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
7. Krishna Raju, and N.Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
8. Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
9. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

SEMESTER SCHEME 2020-21

ESTIMATION, COSTING AND VALUATION LAB

Course Code	CE 5006 (Same as CC/CV 5006)
Course Title	Estimation and Costing Lab.
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the procedure for estimating and costing of Civil Engineering works.
- To perform rate analysis for different items associated with construction projects.
- To use software for detailed estimate related to civil infrastructural projects.

COURSE OUTCOMES

After completing this course, student will be able to:

- Select modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Use relevant software for estimating the quantities and cost of items of works.
- Justify rate for given items of work using rate analysis techniques.

LIST OF PRACTICAL TO BE PERFORMED

1	Prepare the list of items to be executed with units for detailed estimate of a given structure from the given drawing.
2	Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments required to construct the given structure as mentioned in at Serial number 1 above.
3	Study of items with specification given in the DSR (for any ten item)
4	Recording in Measurement Book (MB) for any four items
5	Prepare bill of quantities of given item from actual measurements. (any four items).
6	Prepare approximate estimate for the given civil engineering works.
7	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).
8	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart, lead statement (G+1 Building) .
9	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)
10	Prepare rate analysis for the given five item of works.
11	Prepare detailed estimate of road of one kilometre length from the given drawing.
12	Prepare detailed estimate of small Septic tank from the given set of drawings.
13	Prepare detailed estimate of well from the given set of drawing.
14	Use the relevant software to prepare detailed estimate of a Road.
15	Use the relevant software to prepare detailed estimate of a residential building.

SUGGESTED LEARNING RESOURCES

1. Datta, B.N., Estimating and Costing in Civil engineering, UBS Publishers Distributors
2. Peurifoy, Robert L. Oberlender, Garold, Estimating construction cost (fifth edition), McGraw Hill Education,, New Delhi.
3. Rangwala, S.C., Estimating and Costing, Charotar Publishing House, Anand.
4. Birdie, G.S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd. Delhi.
5. Patil, B.S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai.
6. Chakraborti, M., Estimating and costing, specification and valuation in civil engineering, Monojit Chakraborti, Kolkata.

7. PWD Schedule of Rates.
8. Ministry of Road Transport and Highways (MORT&H) Specifications and Analysis of Schedule of Rates.
9. Manual of Specifications and Standards for DBFOT projects, EPC works.

SEMESTER SCHEME 2020-21

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR
SEMESTER SCHEME-2020-21



VI SEMESTER
(SESSION 2021-2022 & ONWARDS)

ENTREPRENEURSHIP AND START-UPS

Course Code	CE 6111(Same in All Branches of Engg.)
Course Title	Entrepreneurship and Start-ups
Number of Credits	4 (L- 3,T-1, P-0)
Prerequisites (Course code)	None
Course Category	HS

COURSE LEARNING OBJECTIVES:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship-its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

LEARNING OUTCOME:

Upon completion of the course, these student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. Strategic Marketing Planning
6. New Product or Service Development
7. Business Plan Creation

COURSE CONTENTS:**1. INTRODUCTION TO ENTREPRENEURSHIP AND START-UPS**

- 1.1. Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- 1.2. Types of Business Structures,
- 1.3. Similarities / differences between entrepreneurs and managers.

2. BUSINESS IDEAS AND THEIR IMPLEMENTATION

- 2.1. Discovering ideas and visualizing the business
- 2.2. Activity map
- 2.3. Business Plan

3. IDEA TO START-UP

- 3.1. Market Analysis– Identifying the target market,
- 3.2. Competition evaluation and Strategy Development,
- 3.3. Marketing and accounting,
- 3.4. Risk analysis

4. MANAGEMENT

- 4.1. Company's Organization Structure,
- 4.2. Recruitment and management of talent.
- 4.3. Financial organization and management

5. FINANCING AND PROTECTION OF IDEAS

- 5.1. Financing methods available for start-ups in India
- 5.2. Communication of Ideas to potential investors– Investor Pitch
- 5.3. Patenting and Licenses

6. EXIT STRATEGIES FOR ENTREPRENEURS ,BANKRUPTCY, AND SUCCESSION AND HARVESTING STRATEGY

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN-978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN-978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN-978-0755388974
4.	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Chris Tensen	Harvard business ISBN:978-142219602

SUGGESTED SOFTWARE/LEARNING WEBSITES:

- a. <https://www.fundable.com/learn/resources/guides/startup>
- b. <https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatestructure/>
- c. <https://www.finder.com/small-business-finance-tips>
- d. <https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/>

PROJECT MANAGEMENT

CourseCode	CE 62001(Same in All Branches of Engg.)
CourseTitle	Project Management
NumberOfCredits	3(L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

- To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.
- To develop an understanding of key project management skills and strategies.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand the importance of projects and its phases.
CO2	Analyze projects from marketing, operational and financial perspectives.
CO3	Evaluate projects based on discount and non-discount methods.
CO4	Develop network diagrams for planning and execution of a given project.
CO5	Apply crashing procedures for time and cost optimization.

COURSE CONTENTS**1. CONCEPT OF A PROJECT:**

- 1.1. Classification of projects
- 1.2. Importance of project management
- 1.3. The project Life cycle
- 1.4. Establishing project priorities (scope-cost-time)
- 1.5. Project priority matrix
- 1.6. Work break down structure.

2. CAPITAL BUDGETING PROCESS:

- 2.1. Planning -Analysis-Selection-Financing-Implementation-Review.
- 2.2. Generation and screening of project ideas
- 2.3. Market and demand analysis
- 2.4. Demand forecasting techniques.
- 2.5. Market planning and marketing research process
- 2.6. Technical analysis

3. FINANCIAL ESTIMATES AND PROJECTIONS:

- 3.1. Cost of projects
- 3.2. Means of financing
- 3.3. Estimates of sales and production-cost of production
- 3.4. Working capital requirement and its financing
- 3.5. Profitability project , cash flow statement and balance sheet.
- 3.6. Breakeven analysis.

4. BASIC TECHNIQUES IN CAPITAL BUDGETING:

- 4.1. Non discounting and discounting methods
- 4.2. pay-back period
- 4.3. Accounting rate of return
- 4.4. Net present value
- 4.5. Benefit cost ratio
- 4.6. Internal rate of return.
- 4.7. Project risk.
- 4.8. Social cost benefit analysis and economic rate of return.
- 4.9. Non-financial justification of projects.

5. PROJECT ADMINISTRATION:

- 5.1. Progress payments,
- 5.2. Expenditure planning,
- 5.3. Project scheduling and network planning,
- 5.4. Use of Critical Path Method(CPM),
- 5.5. Schedule of payments and physical progress,
- 5.6. time-cost trade off.
- 5.7. Concepts and uses of PERT
- 5.8. Cost as a function of time,
- 5.9. Project Evaluation and Review Techniques
- 5.10. Cost mechanisms.
- 5.11. Determination of least cost duration.
- 5.12. Post project evaluation.
- 5.13. Introduction to various Project management softwares.

REFERENCE BOOKS

- 1.Project planning, analysis, selection, implementation and review –Prasannachandra–Tata McGraw Hill
- 2.Project Management – the Managerial Process– Clifford F. Gray & Erik W. Larson-McGrawHill
- 3.Project management- David I Cleland- Mcgraw Hill International Edition, 1999
- 4.Project Management– Gopala krishnan– Mcmillan India Ltd.
- 5.Project Management- Harry – Maylor – Peason Publication

RENEWABLE ENERGY TECHNOLOGIES

CourseCode	CE 62002 (Same in All Branches of Engg.)
CourseTitle	Renewable Energy Technologies
NumberOfCredits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

COURSE CONTENTS**1. INTRODUCTION:**

- 1.1. World Energy Use;
- 1.2. Reserves of Energy Resources;
- 1.3. Environmental Aspects OF Energy Utilisation;
- 1.4. Renewable Energy Scenario in India and around the World;
- 1.5. Potentials; Achievements/ Applications;
- 1.6. Economics of renewable energy systems.

2. SOLAR ENERGY:

- 2.1. Solar Radiation;
- 2.2. Measurements of Solar Radiation;
- 2.3. Flat Plate and Concentrating Collectors;
- 2.4. Solar direct Thermal Applications;
- 2.5. Solar thermal Power Generation
- 2.6. Fundamentals of Solar Photo Voltaic Conversion;
- 2.7. Solar Cells;
- 2.8. Solar PV Power Generation;
- 2.9. Solar PV Applications.

3. WIND ENERGY:

- 3.1. Wind Data and Energy Estimation;
- 3.2. Types of Wind Energy Systems;
- 3.3. Performance; Site Selection;
- 3.4. Details of Wind Turbine Generator;
- 3.5. Safety and Environmental Aspects.

4. BIO-ENERGY:

- 4.1. Bio mass direct combustion;
- 4.2. Bio mass gasifiers;
- 4.3. Bio gas plants;
- 4.4. Digesters;

- 4.5. Ethanol production;
- 4.6. Bio diesel;
- 4.7. Cogeneration;
- 4.8. Bio mass Applications.

5. OTHER RENEWABLE ENERGY SOURCES:

- 5.1. Tidal energy;
- 5.2. Wave Energy;
- 5.3. Open and Closed OTEC Cycles;
- 5.4. Small Hydro Geothermal Energy;
- 5.5. Hydrogen and Storage;
- 5.6. Fuel Cell Systems;
- 5.7. Hybrid Systems.

REFERENCE BOOKS

1. Non-Conventional Energy Sources, Rai. G. D., Khanna Publishers, New Delhi, 2011.
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN SponLtd.,UK,2 006.
3. Solar Energy, Sukhatme. S. P., Tata Mc Graw Hill Publishing CompanyLtd. ,New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, G N Tiwari and M K Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment A Policy Analysis for India ,NH Ravindranath, U K Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, R A Ristinen and J J Kraushaar, second edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, J W T widell and A D Weir, ELBS, 2006.

SEMESTER SCHEME 2020-21

PRODUCT DESIGN

CourseCode	CE 63001(Same in All Branches of Engg.)
CourseTitle	Product Design
NumberOfCredits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

- To acquire the basic concepts of product design and development process
- To understand the engineering and scientific process in executing a design from concept to finished product
- To study the key reasons for design or redesign.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand the basic concepts of product design and development process.
CO2	Illustrate the methods to define the customer needs.
CO3	Describe an engineering design and development process.
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept.
CO5	Apply modelling and embodiment principles in product design and development process.

COURSE CONTENTS**1. DEFINITION OF A PRODUCT**

- 1.1. Types of product;
- 1.2. Levels of product;
- 1.3. Product-market mix;
- 1.4. New product development (NPD) process;
- 1.5. Idea generation methods;
- 1.6. Creativity;
 - 1.6.1. Creative attitude;
 - 1.6.2. Creative design process;
- 1.7. Morphological analysis;
- 1.8. Analysis of inter-connected decision areas;
- 1.9. Brain storming.

2. PRODUCT LIFECYCLE;

- 2.1. The challenges of Product development;
- 2.2. Product analysis;
- 2.3. Product characteristics;
- 2.4. Economic considerations;
- 2.5. Production and Marketing aspects;
- 2.6. Characteristics of successful Product development;
- 2.7. Phases of a generic product development process;
- 2.8. Customer need identification;
- 2.9. Product development practices and industry-product strategies.

3. PRODUCT DESIGN

- 3.1. Design by evolution;
- 3.2. Design by innovation;
- 3.3. Design by imitation;
- 3.4. Factors affecting product design;
- 3.5. Standards of performance and environmental factors;
- 3.6. Decision making and iteration;
- 3.7. Morphology of design (different phases);
- 3.8. Role of aesthetics in design.

4. INTRODUCTION TO OPTIMIZATION IN DESIGN

- 4.1. Economic factors in design;
- 4.2. Design for safety and reliability;
- 4.3. Role of computers in design;
- 4.4. Modeling and Simulation;
- 4.5. The role of models in engineering design;
- 4.6. Mathematical modeling;
- 4.7. Similitude and scale models;
- 4.8. Concurrent design;
- 4.9. Six sigma and design for six sigma;
- 4.10. Introduction to optimization in design;
- 4.11. Economic factors and financial feasibility in design;
- 4.12. Design for manufacturing;
- 4.13. Rapid Proto typing (RP);
- 4.14. Application of RP in product design;
- 4.15. Product Development versus Design.

5. DESIGN OF SIMPLE PRODUCTS DEALING WITH VARIOUS ASPECTS OF PRODUCT DEVELOPMENT;

- 5.1. Design Starting from need till the manufacture of the product

REFERENCE BOOKS

- 1.Product Design and Development, Karl T.Ulrichand Steven D.Eppinger, TataMc Graw–Hill edition.
- 2.Engineering Design– George E. Dieter.
- 3.An Introduction to Engineering Design methods Vijay Gupta.
- 4.Merie Crawford: New Product management, McGraw-Hill Irwin.
- 5.Chitale A K and Gupta R C,“ Product Design and Manufacturing”, Prentice Hall of India, 2005.
- 6.Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pears on education.

DISASTER MANAGEMENT

Course Code	CE 63002 (Same in All Branches of Engg.)
Course Title	Disaster Management
Number of Credits	3 (L: 3, T: 0 ,P :0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

Following are the objectives of this course:

- To learn about various types of natural and man-made disasters.
- To know pre and post-disaster management for some of the disasters.
- To know about various information and organizations in disaster management in India.
- To get exposed to technological tools and their role in disaster management.

COURSE OUTCOMES:

- 1.1. After competing this course, student will be:
- 1.2. Acquainted with basic information on various types of disasters
- 1.3. Knowing the precautions and awareness regarding various disasters
- 1.4. Decide first action to be taken under various disasters
- 1.5. Familiarised with organization in India which are dealing with disasters
- 1.6. Able to select IT tools to help in disaster management

COURSE CONTENTS**1. UNDERSTANDING DISASTER**

- 1.1. Understanding the Concepts and definitions of Disaster,
- 1.2. Hazard,
- 1.3. Vulnerability,
- 1.4. Risk,
- 1.5. Capacity–Disaster and Development,
- 1.6. Disaster management.

2. TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS

- 2.1. Geological Disasters (earth quakes, land slides,tsunami, mining);
- 2.2. Hydro-Meteorological Di-sasters (floods, cyclones, lightning, thunder-storms, hailstorms, avalanches, droughts, cold and heat waves)
- 2.3. Biological Disasters (epidemics, pestattacks, forestfire);
- 2.4. Technological Disasters (chemical, industrial, radiological, nuclear)
- 2.5. Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters)
- 2.6. Global Disaster Trends
- 2.7. Emerging Risks of Disasters
- 2.8. Climate Change and Urban Disasters.

3. DISASTER MANAGEMENT CYCLE AND FRAME WORK

- 3.1. Disaster Management Cycle
- 3.2. Paradigm Shift in Disaster Management.
- 3.3. Pre-Disaster
- 3.4. Risk Assessment and Analysis,
- 3.5. Risk Mapping,
- 3.6. Zonation and Microzonation,
- 3.7. Prevention and Mitigation of Disasters,
- 3.8. Early Warning System
 - 3.8.1. Preparedness,
 - 3.8.2. Capacity Development;
 - 3.8.3. Awareness.
- 3.9. During Disaster
 - 3.9.1. Evacuation

- 3.9.2. Disaster Communication
- 3.9.3. Search and Rescue
- 3.9.4. Emergency Operation Centre
- 3.9.5. Incident Comm and System
- 3.9.6. Relief and Rehabilitation
- 3.10. Post-disaster
 - 3.10.1. Damage and Needs Assessment,
 - 3.10.2. Restoration of Critical Infra structure
 - 3.10.3. Early Recovery Reconstruction and Redevelopment;
 - 3.10.4. IDNDR, Yokohama Stretegy, Hyogo Frame-work of Action.

4. DISASTER MANAGEMENT IN INDIA

- 4.1. Disaster Profile of India
- 4.2. Mega Disasters of India and Lessons Learnt.
- 4.3. Disaster Management Act 2005
- 4.4. Institutional and Financial Mechanism,
- 4.5. National Policy on Disaster Management,
- 4.6. National Guidelines and Plans on Disaster Management;
- 4.7. Role of Government (local, state and national),
- 4.8. Non-Government and Inter Governmental Agencies

5. APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT

- 5.1. Geo informatics in Disaster Management (RS, GIS, GPS and RS).
- 5.2. Disaster Communication System (Early Warning and Its Dissemination).
- 5.3. Land Use Planning and Development Regulations,
- 5.4. Disaster Safe Designs and Constructions,
- 5.5. Structural and Non Structural Mitigation of Disasters
- 5.6. S & T Institutions for Disaster Management in India

REFERENCES

- 1.Publications of National Disaster Management Authority (NDMA) on Various Templates and Guide lines for Disaster Management
- 2.Bhandani, R. K., An over view on natural & man-made disasters and their reduction, CSIR, New Delhi
- 3.Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
- 4.Alexander, David, Natural Disasters, Kluwer Academic London
- 5.Ghosh, G .K. ,Disaster Management, APH Publishing Corporation
- 6.Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

INDIAN CONSTITUTION

CourseCode	CE 6333(Same in All Branches of Engg.)
CourseTitle	Indian Constitution
NumberOfCredits	0 (L:2,T:0;P:0)
Prerequisites(Coursecode)	None
CourseCategory	AU

COURSE CONTENT**1. THE CONSTITUTION –**

- 1.1. Introduction
- 1.2. The History of the Making of the Indian Constitution
- 1.3. Preamble and the Basic Structure, and its interpretation
- 1.4. Fundamental Rights and Duties and their interpretation
- 1.5. State Policy Principles

2. UNION GOVERNMENT

- 2.1. Structure of the Indian Union
- 2.2. President– Role and Power
- 2.3. Prime Minister and Council of Ministers
- 2.4. Lok Sabha and Rajya Sabha

3. STATE GOVERNMENT

- 3.1. Governor– Role and Power
- 3.2. Chief Minister and Council of Ministers
- 3.3. State Secretariat

4. LOCAL ADMINISTRATION

- 4.1. District Administration
- 4.2. Municipal Corporation
- 4.3. Zila Panchayat

5. ELECTION COMMISSION

- 5.1. Role and Functioning
- 5.2. Chief Election Commissioner
- 5.3. State Election Commission

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L.Fadia	Sahitya Bhawan; New edition(2017)
3.	Introduction to the Constitution of India	D D Basu	Lexis Nexis; Twenty-Third 2018 edition

SUGGESTED SOFTWARE / LEARNING WEBSITES:

1. <https://www.constitution.org/cons/india/const.html>
2. <http://www.legislative.gov.in/constitution-of-india>
3. <https://www.sci.gov.in/constitution>
4. <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

PUBLIC HEALTH ENGINEERING

Course Code	CE 6001 (Same as CC 6001)
Course Title	Public Health Engineering
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the principles for identification of sources of surface and subsurface water
- To learn calculation of population and requirement of drinking water
- To understand the plotting of water supply scheme highlighting different features
- To know evaluation of characteristics and treatment of sewage.

COURSE OUTCOMES

After completing this course, student will be able to:

- Know the procedure to identify the sources of surface and subsurface water
- Estimate the quantity of drinking water required for a population
- Draw labeled layout for water supply scheme.
- Device suitable water treatment technique.
- Evaluate the characteristics and suggest treatment of sewage.

COURSE CONTENT**1. Sources, Demand and Quality of water**

1.1 Water supply schemes –

1.1.1 Objectives

1.1.2 Components

1.2 Sources of water:

1.2.1 Surface and Subsurface sources of water

1.2.2 Intake Structures

1.2.3 Definition and types

1.2.4 Factors governing the location of an intake structure

1.3 Demand of water:

1.3.1 Factors affecting rate of demand

1.3.2 Variations of water demand

1.3.3 Forecasting of population

1.3.4 Methods of forecasting of population

1.3.5 Simple problems on forecasting of population

1.3.6 Design period

1.3.7 Estimating of quantity of water supply required for city or town

1.4 Quality of water:

1.4.1 Need for analysis of water,

1.4.2 Characteristics of water-

1.4.2.1 Physical, Chemical and Biological (only introduction)

1.4.2.2 Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN

1.4.2.3 Sampling of water

1.4.2.4 Water quality standards as per IS 10500

2. Purification of water

2.1 Purification of Water:

2.1.1 Objectives of water treatment,

2.1.2 Aeration- objects and methods of aeration

2.2 Plain sedimentation (No Numerical Problem)

2.2.1

- 2.2.2 Sedimentation with coagulation
- 2.2.3 Types Of Coagulants
- 2.2.4 Jar Test
- 2.2.5 Process Of Coagulation
- 2.2.6 Types Of sedimentation tanks
- 2.2.7 Clariflocculator.
- 2.3 Filtration –
 - 2.3.1 Mechanisation Of Filtration,
 - 2.3.2 Classification Of filters:
 - 2.3.2.1 Slow Sand Filter
 - 2.3.2.2 Rapid Sand Filter
 - 2.3.2.3 Pressure filter
 - 2.3.3 Construction and working of
 - 2.3.3.1 Slow Sand Filter
 - 2.3.3.2 Rapid Sand Filter,
 - 2.3.4 Operational problems in filtration.
 - 2.3.5 Disinfection:
 - 2.3.5.1 Objects,
 - 2.3.5.2 Methods of disinfection
 - 2.3.5.3 Chlorination-
 - 2.3.5.3.1 Application Of Chlorine
 - 2.3.5.3.2 Forms Of Chlorination
 - 2.3.5.3.3 Types Of Chlorination Practices
 - 2.3.5.3.4 Residual Chlorine And Its Importance
 - 2.3.5.3.5 Flow Diagram of water treatment plants.
- 3. **Conveyance and Distribution of water**
 - 3.1 Conveyance:
 - 3.1.1 Types of Pipes used for conveyance of water
 - 3.1.2 Choice of pipe material
 - 3.1.3 Types of joints & Types of valves- their use, location and function on a pipeline
 - 3.2 Distribution of water:
 - 3.2.1 Methods of distribution of water-
 - 3.2.1.2 Gravity
 - 3.2.1.3 Pumping, and combined system
 - 3.2.1.4 Service reservoirs - functions and types
 - 3.2.1.5 Layouts of distribution of Water-
 - 3.2.1.5.1 Dead End System
 - 3.2.1.5.2 Grid Iron System
 - 3.2.1.5.3 Circular System
 - 3.2.1.5.4 Radial System
 - 3.2.1.5.5 Their Suitability, advantages and disadvantages.
- 4. **Domestic sewage and System of Sewerages**
 - 4.1 Building Sanitation:
 - 4.1.1 Necessity of sanitation,
 - 4.1.2 Necessity to treat domestic sewage
 - 4.1.3 Definitions –
 - 4.1.3.1 Sewage
 - 4.1.3.2 Sullage
 - 4.1.3.3 Types of sewage
 - 4.1.4 Definition of the terms related to Building Sanitation-
 - 4.1.4.1 Water pipe
 - 4.1.4.2 Rain water pipe
 - 4.1.4.3 Soil pipe, Sullage pipe, Vent pipe
 - 4.1.5 Building Sanitary fittings-
 - 4.1.5.1 Water closet –
 - 4.1.5.1.1 Indian type

- 4.1.5.1.2 European type,
- 4.1.5.2 Flushing cistern,
- 4.1.5.3 Wash basin,
- 4.1.5.4 Sinks,
- 4.1.5.5 Urinals.
- 4.1.5.6 Traps-
 - 4.1.5.6.1 Types
 - 4.1.5.6.2 Qualities of good trap
- 4.1.5.7 Systems of plumbing –
 - 4.1.5.7.1 One Pipe
 - 4.1.5.7.2 Two Pipe
 - 4.1.5.7.3 Single Stack
 - 4.1.5.7.4 Choice Of System
 - 4.1.5.7.5 Inspection and junction chambers, their necessity, location, size and shape.
- 4.2 Systems of Sewerage and Sewer Appurtenances:
 - 4.2.1 Types of Sewers
 - 4.2.2 Systems of sewerage
 - 4.2.3 self-cleansing velocity and non-scouring velocity
 - 4.2.4 Laying, Testing and maintenance of sewers
 - 4.2.5 Manholes and Drop
- 5. Characteristics and treatment of Sewage**
 - 5.1 Analysis of sewage:
 - 5.1.1 Characteristics of sewage
 - 5.1.2 B.O.D and its significance
 - 5.1.3 C.O.D. and its significance
 - 5.1.4 Central Pollution Control Board Norms for discharge of treated sewage
 - 5.1.5 Objects of sewage treatment
 - 5.1.6 Flow diagram of conventional sewage treatment plant.
 - 5.2 Treatment of Sewage: (Only introduction to terms)
 - 5.2.1 Screening
 - 5.2.2 Types of screens
 - 5.2.3 Grit removal
 - 5.2.4 Skimming
 - 5.2.5 Sedimentation of sewage
 - 5.2.6 Aerobic and anaerobic process
 - 5.2.7 Sludge digestion
 - 5.2.8 trickling filters
 - 5.2.9 Activated sludge process
 - 5.2.10 Disposal of sewage
 - 5.2.11 Oxidation pond
 - 5.2.12 Oxidation ditch
 - 5.2.13 Septic tank
 - 5.2.14 Recycling and Reuse of domestic waste

SUGGESTED LEARNING RESOURCES

1. Sharma S.C, Environmental Engineering, Khanna Publishing House, New Delhi
2. Garg, S.K., Environmental Engineering Vol. I and Vol. II, *Khanna Publishers*
3. Birdie, G. S. and Birdie, J. S. Water Supply and Sanitary Engineering, Dhanpat Rai
4. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House, Delhi
5. Rao, C.S., Environmental Pollution Control Engineering, New Age International
6. Punmia, B C, Environmental Engineering, vol. I and II, Laxmi Publishers
7. Peavy H S, Rowe D R, and Tchobanoglous G, Environmental Engineering, McGraw
8. Basak N N, Environmental Engineering, McGraw Hill Publishers.

REPAIRS AND MAINTENANCE OF STRUCTURES

Course Code	CE 60021(Same as CC 60021)
Course Title	Repairs and Maintenance of Structures
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn about types of maintenance techniques
- To understand causes of various types of damages.
- To know about relevant materials for repair.
- To learn methods of retrofitting for different structures.

COURSE OUTCOMES

After completing this course, student will be able to:

- Decide which type of maintenance is needed for a given damaged structure
- Assess causes of damages various types of structures.
- Select the relevant material for repair of the given structure.
- Apply relevant method of retrofitting for re-strengthening of structures.
- Suggest relevant technique to restore the damages of the given structural elements.

COURSE CONTENT**1. Basics of maintenance**

1.1 Types of Maintenances –

- 1.1.1 Repair,
- 1.1.2 Retrofitting,
- 1.1.3 Re-Strengthening
- 1.1.4 Rehabilitation
- 1.1.5 Restoration

1.2 Necessity, objectives and importance of maintenance.

1.3 Approach of effective management for maintenance.

1.4 Periodical maintenance:

- 1.4.1 Check List,
- 1.4.2 Maintenance Manual Containing Building Plan
- 1.4.3 Reinforcement Details
- 1.4.4 Material Sources
- 1.4.5 Maintenance Frequency
- 1.4.6 Corrective Maintenance Procedures and Sources
- 1.4.7 Pre and Post monsoon maintenance.

2. Causes and detection of damages

2.1 Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, deterioration, termites, pollution and foundation settlement.

2.2 Various aspects of visual observations for detection of damages.

2.3 Load test and non-destructive tests (brief description).

- 2.3.1 NDT tests on damaged structure
 - 2.3.1.1 Rebound Hammer
 - 2.3.1.2 Ultrasonic Pulse Velocity
 - 2.3.1.3 Rebar Locator
 - 2.3.1.4 Crack Detection Microscope
 - 2.3.1.5 Digital Crack Measuring Gauge

2.4 Chemical test –

- 2.4.1 Chloride Test
- 2.4.2 Sulphate Attack

- 2.4.3 Carbonation test
- 2.4.4 ph Measurement
- 2.4.5 Resistivity Method
- 2.4.6 Half-Cell Potential Meter (Introduction and demonstration only)

3 Materials for maintenance and repairs

- 3.1 Types of repair material, material selection.
- 3.2 Essential parameters for maintenance and repair materials such - bond with substrate, durability.
- 3.3 Waterproofing materials based on
 - 3.3.1 Polymer modified cement slurry,
 - 3.3.2 UV resistant acrylic polymer,
 - 3.3.3 Ferro-cement.
- 3.4 Repairing materials for masonry:
 - 3.4.1 Plastic/Aluminum Nipples
 - 3.4.2 Non-Shrink Cement
 - 3.4.3 Polyester Putty Or 1:3 Cement Sand Mortar
 - 3.4.4 Galvanized Steel Wire Fabrics And Clamping Rods
 - 3.4.5 Wire Nails
 - 3.4.6 Ferro-Cement Plates.
- 3.5 Repairing materials for RCC:
 - 3.5.1 Epoxy Resins
 - 3.5.2 Epoxy Mortar
 - 3.5.3 Cement Mortar Impregnated With Polypropylene And Silicon
 - 3.5.4 Polymer Concrete Composites
 - 3.5.5 Sealants
 - 3.5.6 Fiber Reinforcement Concrete
 - 3.5.7 Emulsions And Paints

4 Maintenance and repair methods for masonry Construction

- 4.1 Causes of cracks in walls
 - 4.1.1 Bulging Of Wall, Shrinkage
 - 4.1.2 Bonding, Shear
 - 4.1.3 Tensile
 - 4.1.4 Vegetation
- 4.2 Probable crack location:
 - 4.2.1 Junction Of Main And Cross Wall
 - 4.2.2 Junction Of Slab And Wall
 - 4.2.3 Cracks In Masonry Joints
- 4.3 Repair methods based on crack type –
 - 4.3.1 For minor & medium cracks (width 0.5 mm to 5mm): grouting
 - 4.3.2 For major cracks (width more than 5mm): fixing mesh across cracks,
 - 4.3.3 RCC band,
 - 4.3.4 Installing Ferro-Cement Plates At Corners
 - 4.3.5 Dowel Bars
 - 4.3.6 Propping Of Load Bearing
- 4.4 Remedial measures for dampness & efflorescence in wall.

5 Maintenance and repair methods for RCC Construction

- 5.1 Repair stages such as concrete removal and surface preparation, fixing suitable formwork, bonding/passive coat and repair application, various methods of surface preparation.
- 5.2 Repair options such as grouting, patch repairs, carbonated concrete, cleaning the corroded steel, concrete overlays, latex concrete, epoxy bonded mortar and concrete, polymer concrete, corrosion protection such as jacketing.
- 5.3 Building cracks and its prevention, common methods for dormant crack repairs such as Epoxy injection, grooving and sealing, stitching, grouting and guniting/ shotcreting.
- 5.4 Strengthening methods for live cracks such as addition of reinforcements, Jacketing, brackets, collars, supplementary members i.e. shoring, underpinning and propping of framed structure.

SUGGESTED LEARNING RESOURCES

1. Gahlot, P. S., Sharma, S., Building Repair and Maintenance Management, CBS Publishers & Distributors Pvt. Ltd., New Delhi
2. Guha, P. K., Maintenance and Repairs of Buildings, New Central Book Agencies
3. Hutchin Son, B. D., Maintenance and Repairs of Buildings, Newnes-Butterworth
4. Relevant BIS codes

SEMESTER SCHEME 2020-21

TENDERING AND ACCOUNTS

Course Code	CE 60022 (Same as CC 60022)
Course Title	Tendering and Accounts
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand terminologies in contract and tender document and their significance.
- To know different types of contracts and their uses.
- To learn preparation of typical Tender documents for civil engineering work.
- To get acquainted with rent fixation and valuation of civil structures.

COURSE OUTCOMES

After completing this course, student will be able to:

- Understand various types of contract and when they are used
- Suggest the relevant type of contract for the given civil engineering work.
- Prepare the typical Tender document for the given civil engineering work.
- Decide type of payment for the executed work.
- Justify the rent fixation and valuation of given civil structure.

COURSE CONTENT**1. Procedure to execute the work**

- 1.1 Administrative approval,
- 1.2 Technical sanction
- 1.3 Budget provision
- 1.4 Expenditure sanction.
- 1.5 Methods for carrying out works-
 - 1.5.1 Contract Method
 - 1.5.2 Departmental Method
 - 1.5.3 Rate List Method
 - 1.5.4 Piece Work Method
 - 1.5.5 Day's Work Method
 - 1.5.6 Employing Labours On Daily Wages Basis

2. Contracts

- 2.1 Definition of contract, objects of contract, requirements of contract, overview of Indian Contract Act.
- 2.2 Types of engineering contract with advantages, disadvantages and their suitability –
 - 2.2.1 Lump Sum Contract
 - 2.2.2 Item Rate Contract
 - 2.2.3 Percentage Rate Contract
 - 2.2.4 Cost Plus Percentage
 - 2.2.5 Cost Plus Fixed Fee
 - 2.2.6 Cost Plus Variable Percentage And Cost Plus Variable Fee Contract
 - 2.2.7 Labour Contract
 - 2.2.8 Demolition Contract
 - 2.2.9 Target Contract
 - 2.2.10 Negotiated Contract
 - 2.2.11 Engineering Procurement Construction Contract (EPC)
 - 2.2.12 Annuity Contract
- 2.3 Introduction of FIDIC Conditions of contract.
- 2.4 Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor.
- 2.5 Build Operate Transfer (BOT) Project,
- 2.6 BOT Toll contract,

- 2.7 BOT (Annuity) contract,
- 2.8 Design, Build, Finance, Operate and Transfer (DBFOT) contract,
- 2.9 Hybrid Annuity contract,
- 2.10 Operate Maintain and Transfer (OMT) contract,
- 2.11 Operation & Maintenance contract (Introduction only).

3. Tender and Tender Documents

- 3.1 Definition of tender, necessity of tender
 - 3.1.1 Types of tender-
 - 3.1.1.1 Local
 - 3.1.1.2 Global
 - 3.1.1.3 Limited
- 3.2 E -Tendering System –
 - 3.2.1 Online procedure of submission and opening of bids (Technical and Financial).
- 3.3 Notice to invite tender (NIT)-
 - 3.3.1 Points to be included while drafting tender notice
 - 3.3.2 Drafting of tender notice
- 3.4
 - 3.4.1 Procedure of submitting filled tender Documents (Two envelope system)
 - 3.4.2 Procedure Of Opening Tender
 - 3.4.3 Comparative Statement
 - 3.4.4 Scrutiny Of Tenders
 - 3.4.5 Award Of Contract
 - 3.4.6 Letter of Award
- 3.5 Meaning of terms –
 - 3.5.1 Earnest Money Deposit (EMD)
 - 3.5.2 Performance Security Deposit
 - 3.5.3 Validity period
 - 3.5.4 corrigendum to tender notice and its necessity
 - 3.5.5 Unbalanced bid
- 3.6 Tender documents –
 - 3.6.1 Index,
 - 3.6.2 Tender Notice,
 - 3.6.3 General Instructions,
 - 3.6.4 Special Instructions,
 - 3.6.5 Schedule A, Schedule B, Schedule C Etc.
- 3.7 Terms related to tender documents –
 - 3.7.1 Contract conditions-
 - 3.7.1.1 Time Limit
 - 3.7.1.2 Time Extension
 - 3.7.1.3 Penalty
 - 3.7.1.4 Defective Material And Workmanship
 - 3.7.1.5 Termination Of Contract
 - 3.7.1.6 Suspension Of Work
 - 3.7.1.7 Subletting Of Contract
 - 3.7.1.8 Extra Items
 - 3.7.1.9 Price Variation Clause(Escalation)
 - 3.7.1.10 Defect Liability Period
 - 3.7.1.11 Liquidated Damages
- 3.8 Arbitration-
 - 3.8.1 Meaning
 - 3.8.2 Qualification of an arbitrator
 - 3.8.3 Appointment
 - 3.8.4 Dispute and Settlement of disputes
 - 3.8.5 Arbitration and Conciliation Act
 - 3.8.6 Arbitration award

3.8.7

4. Accounts

4.1 Various account forms and their uses –

- 4.1.1 Measurement Books
- 4.1.2 E- Measurement book (E-MB)
- 4.1.3 Nominal Muster Roll (NMR)
- 4.1.4 Imprest Cash
- 4.1.5 Indent
- 4.1.6 Invoice, Bill
- 4.1.7 Vouchers
- 4.1.8 Hand receipt Cash Book
- 4.1.9 Temporary Advance.
- 4.1.10 Heads of Accounts

4.2 Mode of Payment to the contractor and its necessity

- 4.2.1 Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E - payment.

5. Introduction to Valuation

5.1 Definition and purpose of Valuation, role of value

- 5.1.1 Definition –
 - 5.1.1.1 Cost
 - 5.1.1.2 Price and Value
 - 5.1.1.3 Characteristics of Value
 - 5.1.1.4 Factors Affecting Value

5.2 Types of Value –

- 5.2.1 Book Value
- 5.2.2 Scrap Value
- 5.2.3 Salvage Value
- 5.2.4 Speculative Value
- 5.2.5 Distress Value
- 5.2.6 Market Value
- 5.2.7 monopoly Value
- 5.2.8 Sentimental Value. Factors affecting value

5.3 Depreciation, Obsolescence, Sinking Fund,

- 5.3.1 Methods of Calculation of Depreciation –
 - 5.3.1.1 Straight Line Method
 - 5.3.1.2 Sinking Fund Method
 - 5.3.1.3 Constant Percentage Method

5.4 Fixation of rent

- 5.4.1 Lease –
 - 5.4.1.1 Types Of Lease
 - 5.4.1.2 Lease Hold Property
 - 5.4.1.3 Free Hold Property
- 5.4.2 Mortgage –
 - 5.4.2.1 Mortgage deed
 - 5.4.2.2 Precautions to be taken while making mortgage

SUGGESTED LEARNING RESOURCES

1. Datta, B. N., Estimating and Costing in Civil engineering, UBS Publishers Pvt. Ltd., New Delhi
2. Raina, V. K., Construction Management and Contract Practices, Shroff Publishers & Distributors Pvt. Ltd.
3. Rangawala, S. C., Estimating and Costing, Charotar Publishing House PVT. LTD., Gujrat
4. Birdie, G. S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd., New Delhi
5. Patil, B. S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai
6. Chakraborti, M., Estimating and Costing, Specification and Valuation in Civil Engineering, Monojit Chakraborti, Kolkata.

PUBLIC HEALTH ENGINEERING LAB

Course Code	CE 6003 (Same as CC 6003)
Course Title	Public Health Engineering Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the tests for measuring quality of drinking water.
- To learn determination of BOD and COD requirement in sewage.
- To understand the plotting of water supply scheme highlighting different features.

COURSE OUTCOMES

After completing this course, student will be able to:

- Perform various tests to assess quality of water.
- Estimate dissolved solids as per BIS codes.
- Measure BOD and COD of sewage sample.
- Draw line diagram of water pipeline system for a locality.

LIST OF PRACTICAL TO BE PERFORMED

1	Determine pH value of given sample of water.
2	Determine the turbidity of the given sample of water.
3	Determine residual chlorine in a given sample of water.
4	Determine suspended, dissolved solids and total solids of given sample of water.
5	Determine the dissolved oxygen in a sample of water.
6	Undertake a field visit to water treatment plant and prepare a report.
7	Determine the optimum dose of coagulant in a given raw water sample by jar test.
8	Draw sketches of various valves used in water supply pipe line
9	Draw a sketch of one pipe and two pipe system of plumbing
10	Determine B.O.D. of given sample of sewage.
11	Determine pH value of given sample of sewage.
12	Determine suspended solids dissolved and total solids for sample of sewage.
13	Determine the dissolved oxygen in the given sample of sewage.
14	Determine C.O.D. of given sample of sewage.
15	Prepare a report of a field visit to sewage treatment plant

SUGGESTED LEARNING RESOURCES

1. Sharma S.C, Environmental Engineering, Khanna Publishing House, New Delhi
2. Garg, S.K., Environmental Engineering Vol. I and Vol. II, *Khanna Publishers*
3. Birdie, G. S. and Birdie, J. S. Water Supply and Sanitary Engineering, Dhanpat Rai
4. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House, Delhi
5. Rao, C.S., Environmental Pollution Control Engineering, New Age International
6. Punmia, B C, Environmental Engineering, vol. I and II, Laxmi Publishers
7. Peavy H S, Rowe D R, and Tchobanoglous G, Environmental Engineering, McGraw
8. Basak N N, Environmental Engineering, McGraw Hill Publishers.
