



**SGGS Institute of Engineering & Technology, Nanded**  
*(Government Aided Autonomous Institute)*  
**Department of Civil Engineering**

**Final Year B.Tech (Civil Engineering) SYLLABUS**

**CHOICE BASED CREDIT SYSTEM**

**EFFECTIVE FROM : 2021-2022**



**SGGS Institute of Engineering & Technology, Nanded**  
(Government Aided Autonomous Institute)  
**Department of Civil Engineering**

**Final Year B.Tech. (Civil Engineering) Curriculum Structure**  
**Academic Year 2021-22 onwards**

**Program Education Objectives (PEOs)**

The Graduates will be able to:

<b>PEO1</b>	Pursue a successful career in the diversified sectors of the engineering industry and/or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.
<b>PEO2</b>	Analyze and design Civil engineering systems with social awareness and responsibility.
<b>PEO3</b>	Exhibit professionalism and ethical approach through leadership, team work, good communication skills, and adapt to modern trends by engaging in lifelong learning.

**Program Outcomes (POs)**

On successful completion, graduates will be able to:

<b>PO1</b>	Apply knowledge of mathematics, science and engineering to civil engineering problems.
<b>PO2</b>	Identify, formulate and solve civil engineering problems.
<b>PO3</b>	Design various structures or particular system that meets desired specifications and requirements.
<b>PO4</b>	Design and conduct experiments, interpret and analyze data, synthesize the information to derive conclusions.
<b>PO5</b>	Select and use appropriate engineering techniques and software tools to analyze civil engineering problems with understanding of their applicability and limitations.
<b>PO6</b>	Assess local and global impact of societal issues on civil engineering profession.
<b>PO7</b>	Able to understand the impact of engineering solutions on society and demonstrate the knowledge for sustainable development.
<b>PO8</b>	Demonstrate their professional and ethical responsibilities.
<b>PO9</b>	Able to function as a member or a leader on engineering and science teams in various areas of civil engineering.
<b>PO10</b>	Communicate effectively in both verbal and written forms.
<b>PO11</b>	Understand and practice engineering and management principles.
<b>PO12</b>	Adapt transformations in industry through independent and lifelong learning.

**Program Specific Outcomes**

**PSO1:** Establish a Civil Engineering career in industry, government or academic field and achieve professional expertise as appropriate.

**PSO2:** Execute innovation and excellence in Civil engineering problem solving and design in global and societal contexts.



**Shri Guru Gobind Singhji Institute of Engineering and Technology, Vishnupuri, Nanded**

**DEPARTMENT OF CIVIL ENGINEERING**

**Curriculum Structure of B. Tech.  
(With effective from 2021-2022)**

<b>Semester I</b>						
<b>Course Code</b>	<b>Name of the course</b>			<b>P</b>	<b>Credits</b>	
					<b>Th.</b>	<b>Pr.</b>
PCC-CE401	Advanced Concrete Structures	03	--	02	03	01
PCC-CE402	Engineering Economics, Estimation and Costing	03	--	02	03	01
PCC-CE403	Foundation Engineering	03	--	--	03	--
PEC-CE4**	Elective-IV	03	--	--	03	--
PEC-CE4**/ OEC-CE411	Elective-V	03	--	--	03	--
PEC-CE4**	Elective-VI	03	--	--	03	--
SEM-CE416	Seminar	--	--	02	--	01
<b>Total</b>		<b>18</b>	<b>--</b>	<b>06</b>	<b>21</b>	

<b>Semester II</b>						
<b>Course Code</b>	<b>Name of the course</b>			<b>P</b>	<b>Credits</b>	
					<b>Th.</b>	<b>Pr.</b>
PRJ-CE417	Project (Industry/In-house)	--	--	30	--	15
HMC-CE418	Professional Practice, Law & Ethics	03	--	--	03	--
<b>Total</b>		<b>03</b>	<b>--</b>	<b>30</b>	<b>03</b>	<b>15</b>

L-No.of Lecture Hours/week, T-No.of Tutorial Hours/week, P-No.of Practical Hours/week

B.Tech.(Civil)	Contact Hours	Credits
<b>TOTAL</b>	<b>57</b>	<b>39</b>

- The evaluation of 'Theory Course' shall be continuous and consist of In-semester Evaluation I (ISE-I) of 20 Marks, Mid Term Examination (30 Marks), In semester Evaluation II (ISE-II) of 20 Marks and End Term Examination (30 marks) as per the academic Calendar of the institute.
- The evaluation of term work (practical examination) shall be continuous as per the academic Calendar of the institute.
- Student can register for more courses other than prescribed (May be from other department or open electives) as per his/her interest and those credits will be treated as over and above.

<b>Elective-IV</b>		<b>Elective-V</b>	
PEC-CE404	Advanced Structural Analysis	PEC-CE408	Construction Engineering & Management
PEC-CE405	Integrated Water Resource Management	PEC-CE409	Traffic Engineering and Control
PEC-CE406	Airport Engineering & Harbour	PEC-CE410	Structural Dynamics

PEC-CE407	Water Conservation & Management	OEC-CE411	Operation Research ( <i>Institute Open Elective</i> )
<b>Elective-VI</b>			
PEC-CE412	Bridge Analysis and design		
PEC-CE413	Environmental Impact Assessment and Life Cycle Analyses		
PEC-CE414	Town and country planning		
PEC- CE415	Advanced Construction Materials		

**Open Elective/s offered by department: 1) OEC-CE411 Operation Research**

## SEMESTER - VII

<b>PCC-CE401</b>	<b>ADVANCED CONCRETE STRUCTURES</b>	<b>L:03, T:00, P:02</b>	<b>Credits: 04</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	Recall the fundamentals of strength of material and concrete technology and RCC structures.
CO2	Understand the basic concepts of structural design methods of RCC and PSC to solve the practical problem.
CO3	Apply the concepts and applications of RCC and PSC in real practical problems.
CO4	Analysis and design of RCC and PSC elements.
CO5	Formulate design philosophy for any given RCC and PSC structures.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	--	--	--	--	--	--	--	--	--	--
CO2	1	2	1	--	--	--	--	--	--	--	3	--
CO3	3	2	--	--	--	1	--	--	--	--	--	--
CO4	2	3	3	--	--	1	--	--	--	--	--	--
CO5	1	3	3	3	--	--	--	--	--	--	--	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit. 1

Design of circular water tank with roof slab/dome resting on ground by approximate methods/IS code method (**by Working Stress Method**).

Design of rectangular water tank with one-way roof slab resting on ground by approximate methods/ IS code method (**by Working Stress Method**). (7 hrs.)

#### Unit. 2

Analysis and design of columns subjected to biaxial moments. Design of long columns.

Design of Isolated footing, for uniaxial moment, for Square Rectangular & Circular. (7 hrs.)

#### Unit.3

Pre-Stressed Concrete(PSC): Principles of pre-stressing, materials used and their properties, permissible stresses as per IS codes, systems of pre-stressing, losses in pre-stress, design of pre-tensioned and post-tensioned beams- simply supported, rectangular and T- beams, cable profile, end block design.

(8 hrs.)

#### Unit.4 (with LSM)

Design of RCC Cantilever and Counter-fort Retaining wall.

(7 hrs.)

#### Unit .5

Analysis and design of portal frames (single bay single storey) hinged or fixed at base. Design of Strap beam footing and Trapezoidal footing. (9 hrs.)

#### **Unit .6**

Basic concepts of Bunkers and Silos: Introduction, Components of Bunkers and silos, Airy's Theory Janssen's Theory, IS Code Specifications for Calculation of Loads, Factors Increasing the Bin Loads, Analysis and design procedure of bunkers and silos. (6 hrs.)

NOTE: Use of IS: 456-2000, IS:1343-2012, IS: 875 Part I, Part II & Part III is permitted for theory examinations.

#### **TERM WORK:**

Term Work shall consist of the following:

1. Design and drawing of circular water tanks resting on ground.
2. Design and drawing of underground and on ground rectangular water tank.
3. Design and drawing of PSC girder with end block design.
4. Computer aided design of strap beam or trapezoidal footing
5. Computer aided design of single bay single storey portal frame with hinged or fixed at base.

#### **TEXT BOOKS:**

1. S Unnikrishna Pillai & Devdas Menon, 'Reinforced Concrete Design', Tata McGraw Hill Pub., ISBN-13:978-0074633311, 2001.
2. Jai Krishna & O.P Jain, 'Plain and Reinforced concrete, Volume 1', Nem Chand, ISBN-10 : 8185240086, ISBN-13 : 978-8185240084, Revised Eighth Edition, 2008.
3. Jai Krishna & O.P Jain, 'Plain and Reinforced concrete, Volume 2', Nem Chand, ISBN-10 : 8185240094, ISBN-13 : 978-8185240091, Revised Eighth Edition, 2007.
4. P. Dayaratnam, 'Limit State Design of Reinforced Concrete Structures', OXFORD & IBH PUBLISHING, ISBN-10 : 8120415973, ISBN-13 : 978-8120415973, 2017.
5. B.C.Punmia, Ashok Kumar Jain & Arun Kumar Jain, 'R.C.C. Designs (Reinforced Concrete Structures)', Laxmi Publications, ISBN-10 : 8131809420, ISBN-13 : 978-8131809426, Tenth Edition, 2015.
6. N.Krishna Raju, 'Prestressed Concrete', McGraw Hill Education, ISBN-10 : 9387886204, ISBN-13 : 978-9387886209, Sixth Edition, 2018.

#### **REFERENCE BOOKS:**

1. Dr. A.K. Goel & Dr. IC Syal, 'Reinforced Concrete Structures', S Chand Publishing, ISBN-10 : 9788121923538, ISBN-13 : 978-8121923538, Fourth Edition, 2003.
2. N.K. Raju, 'Advanced Reinforced Concrete Design', CBS Publishers & Distributors Private Limited, ISBN-10 : 9788123929606, ISBN-13 : 978-8123929606, Third Edition, 2016.
3. T.Y. Lin, Ned H. Burns, 'Design of Prestressed Concrete Structures', Wiley India Private Limited, ISBN-10 : 9788126528035, ISBN-13 : 978-8126528035, Third Edition, 2010.
4. James R. Libby, 'Modern Pre-stressed Concrete: Design Principles and Construction Methods', Springer, ISBN-10 : 0442319231, ISBN-13 : 978-0442319236, 1990.

<b>PCC-CE402</b>	<b>ENGINEERING ECONOMICS, ESTIMATION AND COSTING</b>	<b>L:03, T:00, P:02</b>	<b>Credits: 04</b>
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**Course Outcomes:** At the end of the course, the student will be able to

CO1	Recall the fundamentals of building construction, building planning and computer aided drawing.
CO2	Understand the process of various forms of Economics, Indian Economy, preparation of estimates, submission of tender, submission of any contract for government, semi government and private project.
CO3	Apply the basic knowledge acquired through subject for submission of any contract and its execution with a concept of economics.
CO4	Analysis different type of contract in connection with estimation, specification, valuation and quantity surveying with clear understanding of economics.
CO5	Propose the bill of quantities using different techniques of preliminary & detailed estimation of buildings & other structures.

#### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	1	--	--	--	--	--	--	--	--
CO2	1	--	--	--	--	--	--	--	1	--	3	--
CO3	3	3	--	1	--	1	--	--	1	--	--	--
CO4	1	2	--	1	--	1	--	--	1	--	--	--
CO5	--	--	1	--	1	--	--	2	--	--	--	--

1: Slightly

2: Moderately

3: Substantially

#### Course Syllabus:

##### Unit.1

Basic Principles and Methodology of Economics, Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.

Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve. (08 hrs.)

##### Unit.2

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control – Techniques, Types of Costs, Life cycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.

Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F),



Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors. (7 hrs.)

### **Unit.3**

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying (7 hrs.)

### **Unit.4**

Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.Rate analysis - Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment / productivity. (7 hrs.)

### **Unit.5**

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. (7 hrs.)

### **Unit.6**

Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management.

Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights. (7 hrs.)

### **TEXT BOOKS:**

1.N. Gregory Mankiw, 'Principles of Economics', Cengage, ISBN - 10 : 813151739X, ISBN-13 : 978-8131517390, Sixth Edition ,2012.

2.V L Mote; Samuel Paul; G S Gupta,'Managerial Economics-Concepts and cases', Tata McGraw Hill,ISBN-10:0070965188,ISBN-13:978-0070965188,2004.

3.B.N.Dutta,'Estimating and Costing in Civil Engineering (Theory and Practice)',CBS Publishers & Distributors Pvt Ltd,ISBN-10 : 8174767703,ISBN-13 : 978-8174767707,Twenty Eighth Edition,2020.

4.UBS Publishers & Distributors ,'Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuations',ISBN-10 : 8174767290, ISBN-13 : 978-8174767295,Twenty seventh Revised Edition,2017.

5.M.Chakraborti,'Estimating, Costing, Specification & Valuation In Civil Engineering',ISBN-10 : 818530436X,ISBN-13 : 978-8185304366,Twenty ninth revised & Enlarged Edition,2006.

### **REFERENCE BOOKS:**

1.Misra & Puri,'Indian Economy Performance And Policies',Himalaya, ISBN-10 : 8184884354, ISBN-13 : 978-8184884357, 2009.

2.Saroj Pareek,' Textbook of Business Economics', Sunrise Publishers and Distributors, ISBN:9781441655516,2009.

3.P.K.Joy, 'Handbook of Construction Management', Macmillan Publishers India, ISBN-10 : 0333926935, ISBN-13 : 978-0333926932,2000.

4.B.S. Patil , S.P. Woolhouse , 'B.S.Patil's Building and Engineering Contracts,CRC Press,ISBN-10 : 0367133369,ISBN-13 : 978-0367133368,Seventh Edition,2019.

**TERM WORK (P-02)**

Term-work shall consist of the following.

1. Estimate of a two storied building
2. Estimate of a culvert or railway track or canal or road
3. Estimate of a simple RCC framed structure/ Industrial steel structures.
4. Analysis of rates for ten items of construction.
5. Specifications for six items of construction.
6. Valuation report for a building.

<b>PCC-CE403</b>	<b>FOUNDATION ENGINEERING</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	Recall the fundamentals of building construction and geotechnical engineering.
CO2	Identifying the applicability of different foundation design applicable to various types of soil.
CO3	Apply the different design philosophy of foundation applicable to soil.
CO4	Analysis various types of shallow and deep foundations.
CO5	Create understanding applicability of foundation design for different types of soil.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	--	--	--	--	--	--	--	--	--	--
CO2	--	3	--	--	--	1	--	--	--	1	--	--
CO3	1	--	3	1	--	--	--	--	--	--	1	--
CO4	--	1	--	1	--	3	--	--	3	--	--	--
CO5	--	--	--	--	--	--	--	--	--	1	2	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Site investigation: Introduction, General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed, Rock Drilling and Sampling, Core Barrels, Core Boxes, Core Recovery, Field Tests for Bearing Capacity evaluation , Test Procedure & Limitations. (6 hrs.)

#### Unit.2

Bearing Capacity:Theoretical Bearing Capacity Analysis - Failure Modes, Terzaghi's Analysis, Specialization of Terzaghi's Equations, Skempton Values for  $N_c$ , Meyerhof's Analysis, I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure, Settlement Analysis: Causes and control of settlement, immediate settlement, consolidation settlement, differential settlement, prediction of foundation settlement from plate load test, settlement tolerance of superstructures. (8 hrs.)

#### Unit.3

Foundation on Black Cotton Soil: Foundation Construction in Difficult Soils - Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative Measures for Expansive Soils, Modification of Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: Improvement of Cohesive Soils, Improvement of Cohesionless Soils, General Methods for Ground Improvement. (7 hrs.)

#### Unit. 4

Shallow Foundations: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of Isolated, Combined, Strap Footing (Rigid analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation. (6 hrs.)

#### **Unit. 5**

Deep foundations: Pile Foundation: Classification, Pile Driving, Load Carrying Capacity of Piles, Single Pile Capacity, Dynamic Formulae, Static Formulae, Pile Load Tests, Penetration Tests, Negative skin Friction, Under Reamed Piles, Group Action of Piles, Caissons Foundations: Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties And Remedial Measures Sheet Piles: Classification, Design of Cantilever Sheet Pile in Cohesionless and Cohesive soils. Design of Anchored Sheet Pile by Free Earth Support Method, Cellular Cofferdams: Types, Cell Fill Stability Considerations (8 hrs.)

#### **Unit. 6**

Lateral Earth Pressures Theories: applications of earth pressure theories, different types of earth pressure at rest, active and passive pressure. Rankine's Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure Planes for cohesionless and cohesive soils. Coulomb's Wedge Theory: Coulomb's active pressure in cohesionless soils, expression For active pressure, Coulomb's passive earth pressure. Rebhann's Construction for Active Pressure, Culmanns graphical solutions for active soils, Wedge Method, passive pressure by friction circle method for cohesionless and cohesive soils. (8 hrs.)

#### **TEXT BOOKS:**

- 1.W.C.Teng ,‘Foundation Design’, Prentice - Hall Inc., ISBN-10:0133298051, ISBN-13:978-0133298055,1962.
- 2.M.J.Tomlinson , ‘Foundation Design & Construction”, Prentice-Hall Inc., ISBN-13: 978-0130311801,ISBN-10: 0130311804,Seventh Edition, 2001.
- 3.B.M.Das,‘Principles of Foundation Engineering’,Cengage Learning, ISBN-13: 978-049566810, ISBN-10: 0495668109,Seventh Edition,2010.

#### **REFERENCE BOOKS:**

- 1.Donald P Coduto,‘Foundation Design: Principles and Practices’,Prentice - Hall Inc.,ISBN-13: 978-0135897065,ISBN-10: 0135897068,Second Edition,2000.
- 2.D. H. Lee, ‘Sheet piling, cofferdams, and caissons (Concrete series)’, Concrete Publications, ASIN : B0007JRF1G,1949.
- 3.IS 6403:1981, IS 1904:1986, IS 4091:1979.



Matrix method of analysis for plane grids Analysis of symmetrical & unsymmetrical plane grids, space trusses using stiffness approach subjected to member loading (UDL, Conc. Load, Temperature etc.) and joint loads. (7 hrs.)

### **Unit.5**

Solution technique with banded & skyline technique, band minimization, frontal techniques. (6 hrs.)

### **Unit 6.**

Introduction to finite Element method, basic concepts, discretization of structures, Rayleigh Ritz method for bar elements (prismatic/Non-prismatic) Displacement based bar elements (Prismatic/Non-prismatic). (6 hrs.)

### **TEXT BOOKS:**

1. P.N.Godbole, R.Sonparate & S.Dhote, 'Matrix Methods of Structural Analysis', PHI Learning Pvt. Ltd.2014.
- 2.Late Dr.A.S.Meghare & S.K.Deshmukh, 'Matrix Method of Structural Analysis', Charotar Publishing House, Anand, First Edition,2003.
- 3.W.Gere & J.M.Weaver, 'Matrix Method of Structural Analysis', CBS Publishers and Distributors Pvt. Ltd , ISBN-10: 8123911513, ISBN-13: 978-8123911519,2018.
4. S.S.Bhavikatti , 'Finite Element Analysis', New Age International Pvt Ltd Publishers, ISBN-10 : 812241589X, ISBN-13 : 978-8122415896,2004.

### **REFERENCE BOOKS:**

1. Sankarasubramanian G. S. Rajasekaran, 'Computational Structural Mechanics', PHI Learning Private Limited, ISBN-10 : 8120317343, ISBN-13 : 978-8120317345, First Edition,2009.
- 2.M.B.Kanchi , 'Matrix Methods of Structural Analysis', New Age International Private Limited, ISBN-10 : 812244041X, ISBN-13 : 978-8122440416, Third Edition,2016.
- 3.P.N.Godbole, ' An introduction to Finite Element Method', I K International Publishing House Pvt. Ltd, ISBN-10 : 9789382332206, ISBN-13 : 978-9382332206,2013.
4. J. F. Fleming, 'Computer Analysis of Structural Systems', McGraw - Hill College, ISBN-10 : 9780070213012, ISBN-13 : 978-0070213012,1989.

<b>PEC-CE405</b>	<b>INTEGRATED WATER RESOURCE MANAGEMENT</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course, the student will be able to

CO1	Define the role of disciplines of ecology and socio-economics play in management of water resources.
CO2	Understand the complexities dealing with water resources problems.
CO3	Design various components of water resources
CO4	Solve various problems in the field of water resources.
CO5	Students will be exposed to global food security and public-private participation issues and legal and regulatory settings,

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	2	--	1	--	--	1	--
CO2	2	1	1	3	1	--	--	--	--	--	--	--
CO3	1	3	2	1	2	--	1	--	1	--	--	--
CO4	1	1	1	2	--	--	1	--	--	--	1	--
CO5	--	2	1	1	1	--	--	--	1	--	--	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Context for IWRM: Water as a global issue: key challenges and needs – Definition of IWRM within the broader context of development – Complexity of the IWRM process – Examining the key elements of IWRM process. (7 hrs.)

#### Unit.2

Water Economics: Economic view of water issues: economic characteristics of water good and services – Non-market monetary valuation methods – Water economic instruments, policy options for water conservation and sustainable use – Case studies. (7 hrs.)

#### Unit.3

Pricing: distinction between values and charges – Private sector involvement in water resources management: PPP objectives, PPP options, PPP processes, PPP experiences through case studies – Links between PPP and IWRM. (7 hrs.)

#### Unit.4

Water Supply and Health within the IWRM consideration: Links between water and human health: options to include water management interventions for health – Health protection and promotion in the context of IWRM–Health impact assessment of water resources development. (7 hrs.)

## **Unit.5**

Agriculture in the concept of IWRM: Water for food production: „blue“ versus „green“ water debate – Virtual water trade for achieving global water security – Irrigation efficiencies, irrigation methods and current water pricing. (7 hrs.)

## **Unit.6**

Water Legal and Regulatory Settings: Basic notion of law and governance: principles of international and national law in the area of water management. Understanding UN law on non-navigable uses of international water courses – Development of IWRM in line with legal and regulatory framework. (8 hrs.)

### **TEXT BOOKS:**

1. Grigg Nell's, 'Water Resources Planning', McGraw Hill Book company, Washington, ISBN-13: 3-540-23454-3, 1985.
2. Cech Thomas V., 'Principles of Water Resources: History, Development, Management and Policy', John Wiley and Sons Inc., New York, ISBN-13: 978-1-118-79029-8, 2008.
3. V.K. Sharma, 'Water Resources & Water management', Himalaya Publishing Bombay, 1989.

### **REFERENCE BOOKS :**

1. O. Mathews, Paul, 'Water resources Geography and Law', Scientific Publisher, Jodhpur, ISSN: 1818-4952, 1987.
2. H.N. Mishra & V.P. Singh, 'Research Methodology in Geography', Rawat Publication, Jaipur, ISSN 2319- 9318, 1998.
3. Sen & P.K. Das, 'Water utilization of Form level', National Institute of Rural development, Hyderabad, ISSN 2278-3199, 1986.





### **Unit.3**

Terminal Area Design, Grading and Drainage, Air Traffic Control and Visual Aids: Terminal area elements and requirements, terminal building functions, space requirements, location planning concepts, vehicular parking area and Circulation network. passenger requirements at terminal building. Airport grading-importance - operations, airport drainage aims, functions, special characteristics, basic requirements, surface and subsurface drainage systems. Air traffic control-objectives, control system, control network-visual aids-landing information system, airport markings and lighting. (07 hrs.)

### **Unit.4**

Harbour Planning: General: History of water transportation at world level and at national level development and policy, classification of harbours, natural and artificial. Major ports in India, administrative set up. Harbour components, ship characteristics, characteristics of good harbour and principles of harbour planning, size of harbour, site selection criteria and layout of harbours. Surveys to be carried out for harbor planning. (07 hrs.)

### **Unit.5**

Marine Structures, Docks and Locks Natural Phenomena: Wind, waves, tides formation and currents phenomena, their generation characteristics and effects on marine structures, silting, erosion and littoral drift. General design aspects, breakwaters - function, types general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories – function, types, suitability, design and construction features. Tidal basin, wet docks-purpose, design consideration, operation of lock gates and passage, repair docks - graving docks, floating docks. (07 hrs.)

### **Unit.6**

Port Amenities Navigational Aids and Harbour Maintenance: Ferry, transfer bridges, floating landing stages, transit sheds, warehouses, cold storage, aprons, cargo handling equipments, purpose and general description, Channel and entrance demarcation, buoys, beacons, light house electronic communication devices. Coastal protection-purpose and devices, dredging, purpose, methods, dredgers-types, suitability, disposal of dredged materials .mechanical and hydraulic dredgers. (07 hrs.)

#### **TEXT BOOKS:**

- 1.S.K.Khanna , M.G.Arora & S.S.Jain, ‘ Airport Planning and Design’, Nemchand and Brothers, Roorkee, ISBN: 9788185240688,2012.
2. S.C.Rangwala, ‘ Airport Engineering’, Charotar Publishing House,ISBN: 9789380358628 2013.
- 3.S.C.Rangwala, ‘ Harbor Engineering’, Charotar Publishing House, ISBN: 9380358784 2013.
- 4.S.P.Bindra S P, ‘A Course in Docks and Harbour Engineering’, Dhanpat Rai and Sons, New Delhi, ISBN: 9788189928858,2013.

#### **REFERENCE BOOKS:**

- 1.S.C.Saxena, ‘Airport Engineering Planning And Design’,CBS Publishers, ISBN-10 : 8123915500, ISBN-13 : 978-8123915500, 2020.
2. R. Srinivasan and S. C. Rangwala, ‘ Harbour, Dock and Tunnel Engineering’, Charotar Pub. House, Anand, ISBN:978-93-85039-19-5,1995.
- 3.H.P.Oza and G.H. Oza, ‘A course in Docks & Harbour Engineering’,Charotar Publishing Co.,ISBN: 978-93-80358-78-9, Seventh revised and Enlarged Edition,2013.

<b>PEC-CE407</b>	<b>WATER CONSERVATION &amp; MANAGEMENT</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	Recall the concepts of WRE-I and II.
CO2	Understand the concepts related to Soil and water conservation techniques and watershed management
CO3	Apply the knowledge of theories and equations to drainage design, irrigation system management etc.
CO4	Analyse the different practice for soil and water conservation.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	--	--	--	1	--	--	--	--	--
CO2	1	1	--	--	2	--	--	1	1	--	2	--
CO3	3	--	--	--	1	--	1	1	--	2	--	--
CO4	--	--	--	2	--	1	--	--	2	1	--	1

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit 1

Soil Erosion & Its Control: Basic concepts of soil erosion ; Factors affecting soil erosion; Types of erosion: Water erosion, Wind erosion, Gully erosion and Stream bank erosion; Mechanics of soil erosion; Models for estimating soil erosion losses (USLE); Soil erosion control structures and their design: Contour bunding, Graded bunding, Bench terracing and Contour trenching. (09 hrs.)

#### Unit 2

Soil & Water Conservation: Need of soil and water conservation; Water harvesting techniques: Farm Ponds & Percolation Tanks: Selection of site, Survey & Design; Design and construction of Cement Nalla Bandhara (CNB) structures. (08 hrs.)

#### Unit 3

Hydrology of Watershed: Hydrological processes in watershed; Numerical modeling of hydrologic processes in watershed; Estimation of peak design runoff rate: (Rational method and Curve number method). (07 hrs.)

#### Unit 4

Watershed Development & Management: Watershed development: Ridge to Valley Concept; Morphological analysis of watershed; Land use capability classification. (06 hrs.)

## **Unit 5**

Irrigation System Management: Components of irrigation system; Irrigation system management; Participative irrigation management. (06 hrs.)

## **Unit 6**

Land Grading & Drainage: Land grading survey and design: (Plane and Profile methods); Drainage design criteria & drainage equations; Design of surface and subsurface drainage systems. (06 hrs.)

### **TEXT BOOKS:**

1. Murthy, V.V.N., & M.K. Jha, 'Land and Water Management Engineering', Kalyani Publishers, ISBN-10 : 932721465X, ISBN-13 : 978-9327214659, Sixth Edition, 2013.
2. Suresh, R., 'Soil and Water Conservation Engineering', Standard Publishers and Distributors Pvt. Ltd., ISBN-10 : 8180141861, ISBN-13 : 978-8180141867, 2020.

### **REFERENCE BOOKS:**

1. Frevert, R.K., Schwab, G.O. Edminster, T.W. and Barnes, K.K., 'Soil and Water Conservation Engineering', 4th Edition, John Wiley and Sons, New York, 2009.
2. Michael, A.M., 'Irrigation Theory & Practice Engineering', Vikas Publishing House Pvt. Ltd., ISBN-10 : 8125918671, ISBN-13 : 978-8125918677, Second Edition, 2008

<b>PEC-CE408</b>	<b>CONSTRUCTION ENGINEERING &amp; MANAGEMENT</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course, the student will be able to

CO1	Define the fundamental principles of management theories
CO2	Understand the feasibility analysis in construction management and network analysis tools for cost and time estimation
CO3	Apply theoretical and practical aspects of construction management techniques to achieve project goals
CO4	Analyze contemporary construction management tools and methodologies in Indian context.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1	1	2	1	2	1	2	2
CO2	1	2	3	3	2	1	2	1	2	1	1	1
CO3	1	1	3	2	1	2	2	2	2	1	2	1
CO4	1	2	2	2	2	3	3	3	3	1	2	1

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Basics of Construction- Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution; Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

(8 hrs.)

#### Unit.2

Construction Methods basics: Types of foundations and construction methods; Basics of Form work and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

(7 hrs.)

#### Unit.3

Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earth moving, De watering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

(7 hrs.)

#### **Unit.4**

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction. (7 hrs.)

#### **Unit.5**

Project Monitoring & Control- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health. (7 hrs.)

#### **Unit.6**

Contracts Management basics: Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Measure, Suspension and Termination. Changes & variations, Dispute Resolution methods. Construction Costs: Make-up of construction costs; Classification. (7 hrs.)

#### **TEXT BOOKS:**

- 1.R.Chudley, 'Construction Technology', Longman Higher Education, ISBN-10 : 0582322820  
ISBN-13 : 978-0582322820, Second Edition ,1997.
2. Robert Peurifoy , Clifford J. Schexnayder and Aviad Shapira, 'Construction Planning, Equipment and Methods', McGraw Hill Education, ISBN-10 : 9780070706996, ISBN-13 : 978- 0070706996 , Seventh Edition,2010.
- 3.Kumar Neeraj Jha, 'Construction Project Management: Theory and Practice', Pearson, ISBN-13:978-8131732496, First Edition,2011.
4. B.C. Punmia, K.K. Khandelwal, 'Project Planning and Control with PERT and CPM',Laxmi Publications Private Limited,ISBN-10 : 8131806987,ISBN-13 : 978-8131806982,Fourth Edition,2016.
5. S. W. Nunnally , 'Construction Methods and Management', Pearson, ISBN-10 : 0135000793, ISBN-13 : 978-0135000793, Eighth Edition, 2010.

#### **REFERENCE BOOKS:**

1. K. K. Chitkara, 'Construction Project Management', McGraw-Hill, ISBN-10 : 9353166276, ISBN-

13 : 978-9353166274,Forth Edition,2019.

2.P. K. Joy, 'Handbook of Construction Management ', Macmillan Publishers India, ISBN-10 : 0333926935, ISBN-13 : 978-0333926932, 2000.

3.Donald S. Barrie , Boyd C. Paulson , 'Professional Construction Management: Including CM, Design-Construct and General Contracting', McGraw-Hill, Inc, ISBN-10 : 0070038899, ISBN-13 : 978-0070038899, Third Edition,1991.

4. National Building Code, Bureau of Indian Standards, New Delhi, 2017.

5. R. W. King , R. Hudson , 'Construction Hazard and Safety Handbook ',Butterworth-Heinemann, ISBN-10 : 0408013478, ISBN-13 : 978-0408013475,1985.

6.J. M. Antill, R. W. Woodhead,'Critical Path Methods in Construction Practice',Wiley, ISBN: 978-0-471-62057,Forth Edition,1990.

<b>PEC-CE409</b>	<b>TRAFFIC ENGINEERING AND CONTROL</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	Remember the fundamentals of Transportation Engineering I and II.
CO2	Understand the parking systems, riding quality standards, traffic safety and accident study and suggest the solutions to the practical problems.
CO3	Apply basic principles for the geometric design of roads and other traffic controlling devices.
CO4	Analysis of traffic using different methods.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	1	--	--	--	1	--	--	1	--	--	2	--
CO3	3	2	--	--	1	--	--	--	1	--	1	--
CO4	--	--	--	1	--	1	--	--	2	--	--	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit. 1

Elements of Traffic Engineering : Road, Road user & Road Vehicle Characteristics, problems related to heterogeneous traffic.

Traffic Surveys and Data collection : Speed, journey time and delay studies, methods of measurement of spot speed, headway, gaps, volume / capacity surveys, speed, volume-density interrelations, measurements of running and journey speeds, origin-Destination surveys, necessity, survey methods, sample size, data analysis & Presentation. Highway capacity, level of service concepts. (8 hrs.)

#### Unit. 2

Road Signs and Pavement Markings:Importance, Necessity and General principle of traffic sign, Difference types of traffic sign as per IRC Standard and requirement,Function and types of road marking, general principles of longitudinal pavement marking, materials and colour,Marking of various line such as Centre line, Carriage width, Reduction, Pavement Edge line, Obstruction marking, Stop line, Pedestrian crossing &pedestrian marking and Lay out of a signalized Junction.

(7 hrs.)

#### Unit. 3

Traffic Design : Hierarchy of urban roads and their standards, Diverging, merging crossing weaving maneuver's conflict points, types of road junctions ,channelization of traffic flow, traffic rotary design, Grade separated inter-sections, Drive ways, design of pedestrian facilities, Design criteria for separate cycle track, Exclusive Bus lane, ( Bus stop locations and facilities.) introduction to Intelligent Transport system.

(7 hrs.)

#### Unit. 4



Traffic Control Devices : Traffic signs, road markings, traffic signals, design of signalized intersections & signaling systems,(Queuing )Theory, Traffic control aids, and street furniture. Introduction to transport systems, Traffic controls for Expressway. (7 hrs.)

#### **Unit. 5**

Traffic Safety, Enforcement and Education :Elements responsible for accidents, situations in India, Collection and interpretation of accident data and recording in Standard form, Analysis of Accidents. Traffic regulation and E`s of traffic management, Motor Vehicle Acts and Rules, traffic Education, traffic Controls on National Highways. Introduction of Road Safety Audit, Importance,Guidelines suggested by Ministry of Road Transport Highways for Road Safety Audit. (7 hrs.)

#### **Unit. 6**

Urban Traffic: Present traffic scenario. Urban transportation problems, mixed traffic flow, head and administrative set up of traffic cells at various levels, co-ordination with other transport modes. Parking : Parking surveys, on and off street parking, parking systems, parking demand, design of off street parking lot, underground & multistoried parking.(Truck lay bye, bus lay bye, facilities to parking and way side amenities. (7 hrs.)

#### **TEXT BOOKS**

1. S.C.Saxena,‘Textbook of Highway and Traffic Engineering’, CBS Publishers, ISBN-10 : 9788123924175, ISBN-13 : 978-8123924175,2020.
2. L. R. Kadiyali,‘Traffic Engineering and Transport Planning’,Khanna Publishers,ISBN-10 : 817409220X,ISBN-13 : 978-8174092205,1999.
3. R.C.Sigua,‘Fundamentals of Traffic Engineering’,Diliman, Quezon City : University of the Philippines Press, ISBN:9789715425520 9715425526,2008.
4. D.R.Drew,‘Traffic flow theory and control’, McGraw- Hill Book Co., New York, 1968.

#### **REFERENCE BOOKS:**

1. Rune Elvik ,Truls Vaa , Alena Hoye & Michael Sorensen,‘The Handbook of Road Safety Measures’, Emerald Publishing Limited, ISBN-10 : 1848552505, ISBN-13 : 978-1848552500,Second Edition,2009.
- 2.A.D.May, ‘Traffic Flow Fundamentals’,Pearson,ISBN-10 : 0139260722,ISBN-13 : 978-139260728,First Edition,1990.
- 3.T.M.Matson,F.W.Hurd &W.S.Smith,‘Traffic Engineering’,McGraw-Hill Book Co., New York,1955.
- 4.N. J. Garber , L. A Hoel ,‘Traffic and Highway Engineering’,Wadsworth Publishing Co Inc.,ISBN-10 : 113360515X,ISBN-13 : 978-1133605157,Fifth Edition,2013.

<b>PEC-CE410</b>	<b>STRUCTURAL DYNAMICS</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	To recall fundamentals of Mathematics and Engineering Mechanics.
CO2	To Understand the effects of system/model parameters on dynamic response.
CO3	To apply and formulate dynamic equilibrium equations for SDOF and MDOF system
CO4	To analyze SDOF and MDOF systems using classical and numerical methods.
CO5	To evaluate and obtain the response of SDOF, MDOF systems and conduct modal analysis of MDOF Systems.

Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	--	--	--	--	--	--	--	--	--	--
CO2	1	2	1	--	--	--	--	--	--	--	3	--
CO3	3	2	--	--	--	1	--	--	--	--	--	--
CO4	2	3	3	--	--	1	--	--	--	--	--	--
CO5	1	3	3	3	--	--	--	--	--	--	--	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit. 1

Introduction to structural Dynamics, Static and Dynamic load types, Basic definitions, Degree of freedom, SHM, Vibrations of SDOF system- undamped free vibrations, Derivation and solution of equation of motion, Natural frequency and time period. (7 hrs.)

#### Unit. 2

Vibrations of SDOF system- Damped free vibrations, Types of damping, Measurement of damping- Logarithmic decrement method. Damped force vibrations, Response of SDOF system to harmonic excitation, Damped and undamped harmonic excitations. (7 hrs.)

#### Unit. 3

Response to periodic Loading- Fourier series, Response to impulsive loading- Duhamel integral- Rectangular and triangular impulse. Two Degree of freedom system- free vibrations of undamped system, damped free vibrations. (7 hrs.)

#### Unit. 4

Multi-degree of Freedom Systems- Free vibration Analysis- undamped systems, Natural frequency and mode shapes - Vanello Stodola and Matrix iteration methods, Orthogonality and Normality principles, damped system, Forced Vibrations. (7 hrs.)

#### Unit. 5

Time stepping method - Methods based on interpolation of excitation – central difference method- Newark's method - Rayleigh Ritz Methods - Vibrations of building frames - Modal Analysis. Numerical evaluation of dynamic response. (7 hrs.)

**Unit.6**

Response Spectrum- Introduction, Design Spectra, concepts of PGA, Development of Tripartite plot, Response spectrum analysis and Time history analysis. (8 hrs.)

**TEXT BOOKS:**

1. Mario Paz., 'Structural Dynamics - Theory & Computations', CBS Publishers, ISBN-10 : 8123909780, ISBN-13 : 978-8123909783, Second Edition, 2004.
2. R. W. Clough, Joseph Penzien, 'Dynamics of Structures', Mc-Graw-Hill Inc., ISBN-10 : 0070113920, ISBN-13 : 978-0070113923, 1975.
3. A.K. Chopra, 'Dynamics of Structures', Pearson Education, ISBN-10 : 9353945259, ISBN-13 : 978-9353945251, 2020.

**REFERENCE BOOKS:**

1. Madhujit Mukhopadhyay, 'Structural Dynamics: Vibrations and Systems', ANE Books, ISBN-10 : 9788180520907, ISBN-13 : 978-8180520907, 2008.
2. James C. Anderson, Farzad Naeim, 'Basic Structural Dynamics', Wiley, ISBN-10 : 0470879394, ISBN-13 : 978-3540306184, First Edition, 2012.
3. Robert E. Coleman, 'Experimental Structural Dynamics: An Introduction to Experimental Methods of Characterizing Vibrating Structures', Author House, ISBN-10 : 1418411388, ISBN-13 : 978-1418411381, 2004.

<b>OEC-CE411</b>	<b>OPERATIONAL RESEARCH</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	Understand necessity and role of operations research in decision making for real-life problems.
CO2	Analyze a real-life problem using system concepts and system models.
CO3	Apply the concept and process of optimisation.
CO4	Formulate and solve problems using various operations research techniques.
CO5	Practice operations research as a decision-making tool.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	--	--	--	1	--	--	--	--	1	3	--
CO2	2	1	2	1	--	--	1	--	--	--	--	2
CO3	3	2	3	2	--	1	2	1	1	--	--	--
CO4	--	3	2	2	2	1	--	1	1	1	1	--
CO5	--	--	--	--	3	2	--	2	2	2	1	2

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Systems Engineering and operations research: Nature of real-life engineering systems. Systems engineering, systems approach, and systems analysis. Introduction to operations research and its role in solving real-life problems. (7 hrs.)

#### Unit.2

System models and OR techniques: Concept and characteristics of systems. Hierarchy of systems and formulation of systems. System models, their development, and types. Operations research techniques and their classification. Concept and process of optimization. Optimization by method of calculus, Introduction to non-linear programming. (7 hrs.)

#### Unit. 3

Linear Programming: General form of LP and assumptions. Solution of LP models by graphical method and simplex method. Handling artificial variables- the Big-M Method. Introduction to theory of duality. Applications of LP models, Formulation of LP models. (7 hrs.)

#### Unit.4

Transportation, transshipment, and Assignment Problems: The transportation problem- general structure and its relation to LP, Formulation and solution using the transportation algorithm. The transshipment

problem- formulation and solution. The Assignment Problem – Structure and solution using the Hungarian method. (7 hrs.)

### **Unit.5**

Dynamic Programming:Introduction, approach, and methodology. Applications and solutions to DP problems- shortest route problems and resource allocation problems. Curse of dimensionality in DP. Formulation of DP Problems. (7 hrs.)

### **Unit.6**

Inventory Models:Introduction, selective inventory control - ABC, VED, SDE, and FSN analysis. General inventory model - parameters, cost considerations, and assumptions. Infinite delivery rate with no backordering – derivation of economic order quantity (EOQ) formula. Finite delivery rate with no backordering. Infinite delivery rate with backordering. (8 hrs.)

### **TEXT BOOKS:**

1. Prasanna Devidas Dahe ,‘ Operation Research – A Systems Engineering Approach’, Cengage Learning India Pvt. Ltd.,New Delhi,2019.
2. Taha, A.Handy , ‘Operations: An Introduction’, Prentice Hall of India, New Delhi, India,1999.
3. H.M.Wagner, ‘Principles of Operations Research’ , Prentice Hall of India, New Delhi, India,1973

### **REFERENCE BOOKS:**

- 1.T.K.Jewell,‘A Systems Approach to Civil Engineering Planning and Design’, Harper & Row, New York,1986.
- 2.S.S.Rao, ‘Optimization Theory and Applications’, Wiley Eastern Limited New Age International, New Delhi India,1994.
- 3.B.E.Gillet , ‘ Introduction to Operations Research : A Computer-Oriented Algorithmic Approach’, Tata Mc-Graw Hill, New Delhi, India,1979.

<b>PEC-CE412</b>	<b>BRIDGE ANALYSIS AND DESIGN</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	To recall the fundamentals of water resources engineering
CO2	To understand the components of bridges, its classifications and importance.
CO3	To apply various theories of lateral load distribution for component design of bridge
CO4	To analyze any given type of bridge.
CO5	To get exposure to evaluation of sub structures, type of foundations, importance of bearings, lessons from bridge failures.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	1	--	--	--	1	--	--	1	--	--	2	--
CO3	3	2	--	--	1	--	--	--	1	--	1	--
CO4	--	--	--	1	--	1	--	--	2	--	--	--
CO5												

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Introduction and selection of type of Bridges, computation of discharge, linear waterway, economic span, afflux, scour depth Design loads for bridges, introduction to I.R.C. loading standards, Types of loading- Dead load, live load, Impact Effect, Centrifugal force, wind loads, Lateral loads, Longitudinal forces, Seismic loads, Frictional resistance of expansion bearings, Secondary Stresses, Temperature Effect, Erection Forces and effects. (7 hrs.)

#### Unit.2

Analysis of Main Girder for Dead Load & Live Load Using IRC Class AA Tracked, Wheeled Class A Loading Using Courbons Method, Analysis of Main Girder Using Hendry-Jaeger and Morice-Little Method for IRC Class AA Tracked vehicle only, Theories of Lateral Load distribution, and design of Super-Structure, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, Structural Design of main and cross girder with reinforcement details. (7 hrs.)

#### Unit.3

Box Culvert: Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading, working out the worst combination of loading, Moment Distribution, Calculation of BM & SF, Structural Design of Slab Culvert, with Reinforcement Details. Design philosophy for bridges (Deck slab, beam-slab and box). (7 hrs.)

#### **Unit.4**

Substructure : Various parts of substructures, Various types of substructures, Loads acting on substructures, Design of pier and pier cap. Piers: Types, Analysis and Design, Design of Abutments & Wing Walls. Bridge Foundations. (7 hrs.)

#### **Unit.5**

Types of bearings,their functions,design of bearings. Design of Bearings Construction methods and maintenance of Bridges,IRC Provisions for Bearings, Permissible stresses in bearings, Design of Rocker and Roller-cum-Rocker Bearings. (7 hrs.)

#### **Unit.6**

Design of plate girder bridges – steel trussed bridges – Introduction to long span bridges: cable stayed bridges and suspension bridges. (7 hrs.)

#### **TEXT BOOKS:**

- 1.T.R.Jagadeesh & M.A.Jayaram,‘Design of Bridge Structures’, Prentice Hall India Learning Private Limited,ISBN-10 : 8120338529,ISBN-13 : 978-8120338524,Second Edition,2009.
- 2.N.Krishna Raju,‘Design of Bridge’,Oxford & IBH Publishing, ISBN-10 : 8120417984,ISBN-13 : 978-8120417984, Fifth Edition,2019.
- 3.D.J.Victor,‘Essentials of Bridge Engineering’,Oxford,ISBN-10 : 8120417178,ISBN-13 : 978-8120417175,Sixth Edition,2019.
- 4.S.P.Bindra,‘Principles and Practices of Bridge Engineering’,Dhanpat Rai Publications,ISBN-10 : 8189928848,ISBN-13 : 978-8189928841,2012.

#### **REFERENCE BOOKS:**

- 1.V.K.Raina,‘Raina's Concrete Bridge Practice Analysis, Design and Economics’, Shroff Publishers and Distributors Pvt. Ltd, ISBN-10 : 8184043783,ISBN-13 : 978-8184043785,Fourth Edition, 2014.
- 2.Praveen Nagarajan,‘Design of Concrete Bridges: As per Latest IRC Codes’,Wiley,ISBN-10 : 8126599901,ISBN-13 : 978-8126599905,2020.
- 3.R.E.Rowe,‘Concrete Bridge Design’,C.R. books; John Wiley & Sons; Stated First Edition Edition,1962.

<b>PEC-CE413</b>	<b>ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSES</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course outcomes:** at the end of the course, the student will be able to

CO1	Recall fundamental concepts of environmental engineering.
CO2	study general framework for environmental impact assessment.
CO3	Understand the concepts of EIA methodologies, screening and scoping.
CO4	Apply the knowledge of EIA in risk analysis.
CO5	Analyse ad-hoc method, maps and overlays, check lists, matrix, cause condition impacts

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	1	1	1	--	--	--	--	--
CO2	1	2	1	2	1	1	1	--	--	--	--	--
CO3	1	1	1	2	1	1	--	--	--	--	--	--
CO4	1	2	2	1	1	1	2	--	--	--	--	--
CO5	1	2	1	1	1	1	1	--	--	--	--	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Environmental Impact Assessment: Definition and scope, preliminary screening requiring EIA of projects. Impact identification, Assessment of Impact; Impact Evaluation. Types of EIA, rapid and comprehensive. (07 hrs.)

#### Unit.2

General Framework for Environmental Impact Assessment, Characterization and site assessment. Environmental risk analysis, definition of risk, fault tree analysis, consequence Analysis. Methods of environment impact assessment; ad-hoc method, maps and overlays, check lists, matrix, cause condition impacts. (07 hrs.)

#### Unit.3

Procedure For EIA Clearance: EIA review and screening; state level screening, clearance from DOE and MOEF. Socioeconomic aspects, measures of effectiveness of pollution control activities; Environmental Legislation, Introduction to Environmental Management Systems. (07 hrs.)

#### Unit.4



Environmental Statement - procedures; Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource Balance. (07 hrs.)

### **Unit.5**

Environmental Management: Preventive policy of environment, waste minimization, conservation of water and energy, use of renewable, sources, pollution audit, pollution control strategy, disposal of treated effluents, solid waste disposal concept of green cities, green belt development – Case history (08

hrs.)

### **Unit.6**

Energy Balance & Management Review; Operational Control; Case Studies on EIA. (07 hrs.)

### **TEXT BOOKS:**

1. R.K.Jain, G.S.Stacey, L.V.Urban, ‘ Environmental Impact Assessment’, Von Nostrand Reinhold Company, ISBN:0442288077,1981.
2. R.K.Jain, L.V.Urban, G.S.Stacey, E. Balbach, ‘ Environmental Assessment’, McGraw Hill, ISBN -10: 0070323690, ISBN - 13: 9780070323698,1993.
2. Lawrence, P.David, ‘Environmental Impact Assessment (Practical Solutions to Recurrent Problems)’, Wiley International, New Jersey, ISBN 0-471-45722-1,2003.

### **REFERENCE BOOKS:**

1. P.R.Trivedi, ‘Natural Resources Conservation’, APH Publishing Corporation, New Delhi, ISBN-10: 8176485314 ISBN-13: 9788176485319,2004
2. W.E.Westman, ‘Ecology, Impact Assessment and Environment Planning’, John Wiley and Sons, Canada, ISBN: 978-0-471-80895-4,1985.
3. MoEF, GoI, ‘Environment Impact Assessment, Impact Assessment Division’, January 2001 (Manual).
4. Water (Prevention and Control of Pollution) Act 1974.
5. Air (Prevention and Control of Pollution) Act 1981.

<b>PEC-CE414</b>	<b>TOWN AND COUNTRY PLANNING</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course, the student will be able to

CO1	Study norms and aspects of land use planning policies and survey techniques.
CO2	Understand the town planning concepts and theories
CO3	Design and plan residential areas considering socio-economical factors.
CO4	Analyse housing scenarios, policies, norms, bye laws and housing schemes in Indian context.
CO5	Perceived knowledge on various Environmental Legislations and policies.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	2	1	2	1	--	--	--	--	--
CO2	1	2	2	1	2	1	1	1	--	--	--	--
CO3	2	1	1	2	1	1	1	1	--	--	--	--
CO4	1	2	1	1	1	1	1	--	--	--	--	--
CO5	1	1	2	1	1	1	1	--	--	--	--	--

1: Slightly

2: Moderately

3: Substantially

### Course Syllabus:

#### Unit.1

Definitions and Rationales of Planning - Definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning - urbanization, industrialization and urban development; push and pull factors; migration trends and impacts on urban and rural development - rural-urban fringes - city region - area of influence and dominance (06 hrs.)

#### Unit.2

Rural landscapes- regional planning: definition, need and importance, function, objective, concept of region, types of regions, delineation of regions - Types and contents of regional planning for block, district, state, nation, NCR, resource region, agro-climatic region, topographic region and sectoral planning, major regional problems and their solutions. (07 hrs.)

#### Unit.3

Theories of urbanization-Concentric Zone Theory; Sector Theory; Multiple Nuclei Theory; Land Use and Land Value Theory of William Alonso; City as an organism: a physical entity, social entity and political entity — Study of Urban Forms such as Garden City, Precincts, Neighborhoods, - MARS Plan, LeCorbusier Concept, Rad burn Concept (07 hrs.)

#### Unit.4

Urban Structure and its Characteristics - Functions of Transportation Network - concept of accessibility and mobility, Transit Oriented Development (TOD) - Spatial standards for residential, industrial, commercial and recreational areas, space standards for facility areas and utilities, Provisions of Town Planning Act, zoning, subdivision practice, metro region concept. (07 hrs.)

### **Unit.5**

Concept of New Towns: Meaning, role and functions: Special planning and development considerations, scope and limitations of new town development, Indian experience of planning and development of new towns. Urban Renewal: Meaning, significance, scope and limitations, urban renewal as a part of metropolitan plan (07 hrs.)

### **Unit.6**

Town Development Plan: Scope, contents and preparation. A case study of development plan, scope, content and preparation of zonal development plans, plan implementation - organizational legal and financial aspects, public participation in plan formulation and implementation - Techniques of Preparation of Base Maps: Drawing size, scale, format, orientation, reduction and enlargement of base maps. (08 hrs.)

### **TEXT BOOKS:**

1. S.C.Rangwala, 'Town planning', Charotar Publishing House, ISBN-10 : 8192869288, ISBN-13 : 978-8192869285, Twenty Eighth Edition, 2015.
2. G.K.Hiraskar, 'Fundamentals of Town Planning', Dhanpat Rai Publications, ISBN-10 : 8189928899, ISBN-13 : 978-8189928896, 2018.
3. M.P.Rao, 'Urban Planning Theory and Practice', CBS Publishers, ISBN-10 : 8123907575, ISBN-13 : 978-8123907574, 2019.
4. B.K.Pattanaik, 'Introduction to Urban Development and Planning', SAGE Publications India Pvt Ltd, ISBN-10 : 9353883229, ISBN-13 : 978-9353883225, First Edition, 2020.

### **REFERENCE BOOKS:**

1. A.K.Das, 'Urban Planning in India', Rawat Publications, ISBN-10 : 8131600947, ISBN-13 : 978-8131600948, Illustrated Edition, 2007.
2. N.Oppenheimer, 'Applied Models in Urban and Regional Analysis', Prentice Hall, ISBN-10 : 0130414670, ISBN-13 : 978-0130414670, 1980.
3. S.Eisner, A.Gallion & S.Eisner, 'The Urban Pattern', Wiley, ISBN-10 : 0471284289, ISBN-13 : 978-0471284284, Sixth Edition, 1993.
4. N.K Gandhi, 'Study of Town and Country Planning in India', Indian Town and Country planning Association, ASIN : B0044TNBI6, 1973.
5. Wilson, Alan Geoffrey, 'Urban and Regional Models in Geography and Planning', John Wiley and Sons, ISBN-10 : 0471951927, ISBN-13 : 978-0471951926, 1974.

<b>PEC-CE415</b>	<b>ADVANCED CONSTRUCTION MATERIALS</b>	<b>L:03, T:00, P:00</b>	<b>Credits: 03</b>
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**Course Outcomes:** At the end of the course, the student will be able to

CO1	Understand basics of building construction and concrete technology.
CO2	Understand properties and its utilities of concrete,metals and various composites,admixture ,smart and intelligent materials.
CO3	Apply concrete,metals and various composites,admixture ,smart and intelligent materials. For various construction systems.
CO4	Analyse the performance various forms of concrete,metals ,composites,admixture ,smart and intelligent materials.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	--	--	--	--	--	--	--	--	--
CO2	--	--	1	1	--	1	--	--	1	--	3	--
CO3	3	1	--	--	1	--	--	1	--	--	--	--
CO4	1	2	--	1	--	1	--	--	1	--	1	--

1: Slightly

2: Moderately

3: Substantially

#### Unit.1

Study of Special Purpose Cement, Mortar, Concrete - High Strength And High Performance Concrete, Self Compacting Concrete, supplementary cementitious material - Fly Ash, Red Mud, Gypsum, Engineering Grouts, Mortar plaster, Gypsum, Glass. GGBS, micro silica etc. Replacement of aggregates; stone dust, light weight aggregates, recycled aggregate. (7 hrs.)

#### Unit.2

Steels - HYSD, TMT, Tendons, Light Gauge Steel, Steel Fastenings, New Alloy Steels – Aluminum and Its Products, Protective Coatings to Reinforcement. (7 hrs.)

#### Unit.3

A) Polymer and its composites B) Ceramic and its composite, FRC, Ferro cement etc. C) Timber, bamboo, veneer, Laminates, Particle boards. D) Thermal and Sound insulating materials. (7 hrs.)

#### Unit.4

Chemical Admixtures and Adhesives, Water Proofing Compounds – Non Weathering Materials, Geo Synthetics, Geo-Membranes,, Asphalt, Tar & Bituminous Materials, Agro Waste Materials, Industrial Waste Materials, Disposable Materials. (7 hrs.)

#### Unit.5

Materials, Accessories and Proprietary Products - Lumber - Types - Finish - Plywood -Types and grades, Reconstituted wood -Steel -Aluminum Form lining materials, Design Considerations, Building and Erecting the formwork, Causes of Failure of Formwork. (7 hrs.)

**Unit.6**

Smart and Intelligent Materials-Piezoelectric Materials, Shape Memory Alloys & Polymers, Magnetostrictive Materials, Temperature Responsive Polymer, Halo chromic materials, Smart Hydrogels, Chromomeric Systems, Photo mechanical Materials, Self Healing Materials, Dielectric Elastomers.Bio cement, Phase change material. (8 hrs.)

**TEXT BOOKS:**

1. Mohamed Abdallah El-Reedy, 'Advanced Materials and Techniques for Reinforced Concrete Structures', Taylor & Francis, ISBN:9781498724708, Second Edition, 2015.
2. Edward Allen, Joseph Iano, 'Fundamentals of Building Construction: Materials and Methods', Wiley, ISBN-10 : 1119446198, ISBN-13 : 978-111944619, Seventh Edition, 2019.

**REFERENCE BOOKS:**

1. Jaganathan Jayaprakash, Kok Keong Choong, Mohammed Parvez Anwar, 'Advances in Construction Materials and Structures', Springer Verlag, Singapore, ISBN: 9789811591617, First Edition, 2019.
2. S.C.Rangwala, 'Engineering Materials (Material Science)', Charotar Publication House, ISBN-10 : 9380358954, ISBN-13 : 978-9380358956, First Edition, 2014.

<b>SEM-CE416</b>	<b>SEMINAR</b>	<b>L:00, T:00, P:02</b>	<b>Credits: 01</b>
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There is no specific syllabus for this course. However, a student can choose any topic of his/her choice of Engineering topic. The title of the seminar topic should be relevant and currently researched. Students advised referring articles published in current journals in Civil Engineering for choosing their seminar topics. A student should review a minimum of 5 to 6 research papers relevant to the topic selected, in addition to standard textbooks, codebooks, etc. Students required to prepare a seminar report in the standard format and give a presentation before the Seminar Assessment Committee (SAC) in their classmates' presence. All the students must attend the presentations of their classmates.

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

CO1	Identify and choose an appropriate topic of relevance.
CO2	Assimilate literature on technical articles of a specified topic and develop Comprehension.
CO3	Write a technical report.
CO4	Design and develop a presentation on a given technical topic.
CO5	Deliver technical presentation on a specified topic.

#### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	2	3	2	2	1
CO2	2	2	1	3	2	2	3	2	2	1	1	2
CO3	1	1	3	3	2	1	1	1	1	2	2	2
CO4	2	3	2	3	3	1	2	2	3	1	2	1
CO5	1	2	2	1	2	3	3	1	2	1	2	1

1: Slightly

2: Moderately

3: Substantially

## SEMESTER - VIII

<b>PRJ-CE417</b>	<b>PROJECT (INDUSTRY/IN-HOUSE)</b>	<b>L:00, T:00, P:30</b>	<b>Credits:15</b>
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**Course Outcomes:** At the end of the course, the student will be able to

CO1	Understand the basic concepts & broad principles of civil engineering projects.
CO2	Apply the theoretical concepts to solve civil engineering problems with teamwork and a multidisciplinary approach.
CO3	Analyse theoretical /experimental/model-based/ case study for any given civil engineering real-life problem that need to solve using basic knowledge of civil engineering subjects.
CO4	Enable the students to implement project planning in their project work.
CO5	Demonstrate professionalism with ethics; present practical communication and writing skills and relate engineering issues to the broader societal context.

### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	3	2	2	1	2	1
CO2	2	2	3	3	2	3	3	2	2	1	1	2
CO3	3	3	3	3	3	3	3	2	2	2	2	1
CO4	2	2	2	3	3	2	2	2	2	1	2	1
CO5	2	2	3	3	3	3	3	2	3	3	2	2

1: Slightly

2: Moderately

3: Substantially

<b>HMC-CE418</b>	<b>PROFESSIONAL PRACTICE, LAW &amp; ETHICS</b>	<b>L:03, T:00, P:00</b>	<b>Credits:03</b>
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**Course Outcomes:** At the end of the course the student will be able to

CO1	Recall the fundamentals of building construction, building planning and computer-aided drawing and environmental engineering.
CO2	Understand the process to be followed to submit any contract for government, semi-government and private project.
CO3	Apply the basic knowledge acquired through subject for submission of any contract and its execution.
CO4	Analysis of the different type of contract in connection with estimation, specification, valuation and quantity surveying.
CO5	Propose the bill of quantities using different techniques of preliminary & detailed estimation of buildings & other structures.

#### Mapping of course outcomes with programme outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	--	1	--	--	--	--	--	--	--	--
CO2	1	--	--	--	--	--	--	--	1	--	3	--
CO3	3	3	--	1	--	1	--	--	1	--	--	--
CO4	1	2	--	1	--	1	--	--	1	--	--	--
CO5	--	--	1	--	1	--	--	2	--	--	--	--

1: Slightly

2: Moderately

3: Substantially

#### Course Syllabus:

##### Unit.1

Professional Practice – Roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC) (formulating standards of practice); professional bodies (ex. Institution of Engineers (India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies / Planning Authorities) (certifying professionals and offering platforms for interaction); Clients / owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors and concessionaries (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards) ( 8 hrs.)

##### Unit.2

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of



Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. (7 hrs.)

### **Unit.3**

General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations. (7 hrs.)

### **Unit.4**

Time extensions & Force Measure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public Private Partnerships; International Commercial Terms; Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award. (7 hrs.)

### **Unit.5**

Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats, Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017. (7 hrs.)

### **Unit.6**

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies. (7 hrs.)

## **TEXT BOOKS**

1. B.S. Patil , S.P. Woolhouse , 'B.S.Patil's Building and Engineering Contracts', CRC Press, ISBN-10 : 0367133369, ISBN-13 : 978-0367133368, Seventh Edition, 2019.
2. Meena Rao , ' Fundamental concepts in Law of Contract', Professional Offset, Third Edition, 2006.
3. Avtar Singh, 'Contract and special relief', Eastern Book Co., ISBN-10 : 9388822897, ISBN-13 : 978-9388822893, Twelfth Edition, 2020.
4. H. K. Saharay, 'Dutt on Contract: Indian Contract Act 1872', Eastern Law House, ISBN-10 : 8171771181, ISBN-13 : 978-8171771189, Ninth Edition, 2000.
5. G.K.Kwatra, 'Arbitration and Conciliation Law of India', Universal Law Publishing - An imprint of Lexis Nexis, ISBN-10 : 8175346469, ISBN-13 : 978-8175346468, Seventh Edition, 2014.
6. B.L. Wadehra, 'Law Relating to Intellectual Property', Universal Law Publishing - An imprint of Lexis Nexis, ISBN-10 : 9350350300, ISBN-13 : 978-9350350300, Fifth Edition, 2016.
7. O.P. Malhotra , 'The Law of Industrial Disputes', Lexis Nexis, ISBN-10:9351435512, ISBN-13 : 978-9351435518, First Edition, 2015.

### **REFERENCE BOOKS**

1. Neelima Chandiramani , 'The Law of Contract: An Outline', Avinash Publications, Second Edition, Mumbai, 2000.
2. J. Beatson, A. Burrows & J. Cartwright , 'Anson's Law of Contract', Oxford University Press, ISBN-10 : 0199282471, ISBN-13 : 978-0199282470, Twenty Ninth Edition, 2010.
3. T. Ramappa, 'Intellectual Property Rights Law in India', Asia Law House, ISBN-10:9380559151, ISBN-13 : 978-9380559155, First Edition, 2010.
4. R.F. Rustamji, 'Introduction to the Law of Industrial Disputes', Asia Publishing House, ISBN-10 : 021027087X, ISBN-13 : 978-0210270875, Second Edition, 1968.
5. The National Building Code, BIS, 2017
6. RERA Act, 2017