


CMR Institute of Technology, Bangalore		
Department(s): Civil Engineering		
Semester: 06	Section(s): A&B	
Construction Management and Entrepreneurship	15CV61	Lectures/week: 05
Course Instructor(s): Raghavendra P.K		
Course duration: 05 Feb., 2018 – 25 May 2018		

Course Objectives

- Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project.
- Understand the concept of Engineering Economy applicable to Civil Engineering Project and apply for decision making through comparisons of alternatives ,
- Inculcate Human values to grow as responsible human beings with proper personality
- Keep up ethical conduct and discharge professional duties.

Prerequisites

- Basic Knowledge about Construction Types , Materials
- Differential and Integral Calculus

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1 – 12 (out of 5 hrs in a week , this will be covered in First 4 hours per week)	T-1. – management part For Rest T-2, T4 , T6 AND R-1	Module-1 Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans. – (3 hrs) Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles (3 hrs) Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node. (6 hrs)	Chalk and Talk PPT	20
Links to some useful online lectures:				
13 – 24 (out of 5 hrs in a week , this will be covered in First	R-1 , R-8 , T2, T4 and T8 , T5	Module-2 Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. (3 hrs) Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost,	Chalk and Talk Video Lectures for some topics	20

4 hours per week)		operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance (7 hrs) Materials: material management functions, inventory management. (2 hrs)		
Links to some useful online lectures:				
25 – 36 (out of 5 hrs in a week , this will be covered in First 4 hours	T4 , T6	Module-3 Construction Quality , safety and Human Values: Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management (3hrs) HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. (4hrs) Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.	Chalk and Talk PPT Video Lectures for some topics + Flip Class	20
Links to some useful online lectures:				
37 – 48 (out of 5 hrs in a week , this will be covered in First 4 hours	T4,T6,R5	Module-4 Introduction to engineering economy : Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making. (2 hrs) Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost. (6 hrs) Comparison of alternatives : Present worth, annual equivalent , capitalized and rate of return methods , Minimum Cost analysis and break even analysis (4 hrs)	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				
49 – 60 (out of 5 hrs in a week , this will be covered in 5 th hours) 1 Hour per Week , start from First Week	T3	Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions. (3hrs) Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC (3hrs) Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital (6hrs)	Chalk and Talk PPT + Flip Class	20

Links to some useful online lectures:

Text Books

1. P C Tripathi and P N Reddy, “Principles of Management”, Tata McGraw-Hill Education
2. Chitkara, K.K, “Construction Project Management: Planning Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley(India) Pvt. Ltd., Licensees of Pearson Education
4. Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for buildingworks :
6. Construction project management – 2ed – Kumar Neeraj Jha

Reference Books

1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
2. Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadershipperspective”, T.M.H. Edition, New Delhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell
4. Chris Hendrickson and Tung Au, “Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pittsburgh
5. James L.Riggs , David D. Bedworth , Sabah U. Randhawa “ Engineering Economics” 4 ed tata Mc Graw hill.
6. S.C Sharma –“Construction Equipments and its management” – Khanna publishers

Syllabus for Internal Assessment Tests (IAT) *

IAT #	Syllabus
IAT-1	Class # 01 – 20 + 49,50,51,52
IAT-2	Class # 21-36 , +53,54,55,56
IAT-3	Class # 37– 48 + 57,58,59,60

* : See calendar of events for the schedules of IATs.

Course Outcomes

By the end of this course, students will be able to

1. Discuss and apply the Concept of Management to Construction Projects in the areas of Planning , organizing , directing , Motivating and Controlling , Quality , HSE requirements.
2. Identification of Resources required for Construction and Estimation of its Productivity and apply it for selection of Right resources for construction
3. Understand the concept of Engineering Economy applicable to Civil Engineering Project and apply for decision making through comparisons of alternatives ,.
4. Understand and solve variety of issues that are encountered by every professional in discharging professional duties and Fulfilling the professional obligations effectively with global outlook
5. Describe the Concept of Entrepreneurship and analyse and apply the key learnings for Identification of opportunities , sources of funding and relate it for creating business opportunity

COGNITIVE LEVELS	
Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.


PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry.
PSO2	Analyse, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities

CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Discuss and apply the Concept of Management to Construction Projects in the areas of Planning , organizing , directing , Motivating and Controlling , Quality , HSE requirements	1,2,3					2				1	3	3	1	2		3	
CO2	Identification of Resources required for Construction and Estimation of its Productivity and apply it for selection of Right resources for construction	2										1	3	1	2		3	
CO3	Understand the concept of Engineering Economy applicable to Civil Engineering Project and apply for decision making through comparisons of alternatives ,.	4										1	3	1	2		3	
CO4	Understand and solve variety of	3,5								3		1	1		2		3	

	issues that are encountered by every professional in discharging professional duties and Fulfilling the professional obligations effectively with global outlook																	
CO5	Describe the Concept of Entrepreneurship and analyse and apply the key learnings for Identification of opportunities , sources of funding and relate it for creating business opportunity.	5							3	2	3	2	3					3

CMR Institute of Technology, Bangalore		
Department(s): Computer Science & Engineering		
Semester: 06	Section(s): A&B	
Design of Steel Structure	15CV62	Lectures/week: 04
Course Instructor(s): Vibha N Dalawai		
Course duration: 05 Feb., 2018 – 25 May 2018		

Course Objectives

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Prerequisites

- Need to know Rolling of steel elements
- Types of connection and types of steel structure

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-5	TB1: - 1.1, 2.1- 2.9	Module 1 – Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.	Chalk and Talk Video Lectures for some topics	15

Links to some useful online lectures:

- <http://nptel.ac.in/courses/105106112/>
<https://www.youtube.com/watch?v=mtRR-5fzKo8>

5-12 13-20	TB1 5.4-5.18 6.1-6.19	Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages of Bolted and Welded Connections.	Chalk and Talk Video Lectures for some topics	20
---------------	-----------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------	----

Links to some useful online lectures:

- <http://nptel.ac.in/courses/105106112/13>

<ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=BcXZvfEA-e4 ➤ https://www.youtube.com/watch?v=9YZ_jE57YQQ 				
21-32	TB1 8.1-8.17	Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battered Systems.	Chalk and Talk	15
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106112/25 ➤ https://www.youtube.com/watch?v=Nj_HjNRE6-U 				
33-44	TB1 7.1- 7.4 8.1 -8.3	Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets. Design of Column Bases: Design of Simple Slab Base and Gusseted Base.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106112/20 ➤ https://www.youtube.com/watch?v=v_G6JMj_yq8 				
45-56	TB1 9.1 - 9.7	Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams. Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]	Chalk and Talk	20
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106112/36 ➤ 				
57-62	TB1 11.1-11.5	Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams	Chalk and Talk	10
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=pcSvhMpoSDs 				

Text Books	
1.	N Subramanian., “Design of Steel Structures” (2016), Oxford University Press, New Delhi.
2.	Duggal S K., “Limit State Method of Design of Steel Structures”, Tata McGraw Hill, New Delhi
Reference Books:	
\Reference Books	
1.	Dayarathnam P, “Design of Steel Structures”, S Chand and Company Ltd., New Delhi.
2.	Kazim S M A and Jindal R S, “Design of Steel Structures”, Prentice Hall of India, New Delhi
3.	IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi

*

Syllabus for Internal Assessment Tests (IAT)

IAT #	Syllabus
IAT-1	Class # 01 – 20
IAT-2	Class # 21– 44
IAT-3	Class # 45– 62

* : See calendar of events for the schedules of IATs.

Course Outcomes
By the end of this course, students will be able to
1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behavior of structural steel
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

COGNITIVE LEVELS	
Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry.
PSO2	Analyze, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer.
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities.


CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions.	1	2	2	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO2	plastic behavior of structural steel	1	2	3	-	1	-	1	2	1	2	-	-	2	1	-	1	-
CO3	2. Understand the Concept of Bolted and Welded connections.	2	2	3	2	2	2	2	1	-	1	-	-	1	1	-	1	-
CO4	3. Understand the Concept of Design of compression members, built-up columns and columns splices.	3	1	2	1	-	2	1	-	-	-	-	-	1	1	-	1	-
CO5	4. Understand the Concept of Design of tension members, simple slab base and gusseted base.	4	2	2	-	-	2	-	-	-	-	-	-	2	1	-	1	-
CO6	5. Understand the Concept of Design of laterally supported and unsupported steel beams.	5	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1	-

Note : From time to time, assignments will be posted on

<https://sites.google.com/a/cmrit.ac.in/vibha-n-dalawai/>

CMR Institute of Technology, Bangalore		
Department(s): Computer Science & Engineering		
Semester: 06	Section(s): A&B	
Design of Steel Structure	15CV62	Lectures/week: 04
Course Instructor(s): Vibha N Dalawai		
Course duration: 05 Feb., 2018 – 25 May 2018		

Course Objectives

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

Prerequisites

- Need to know Rolling of steel elements
- Types of connection and types of steel structure

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-5	TB1: - 1.1, 2.1- 2.9	Module 1 – Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.	Chalk and Talk Video Lectures for some topics	15

Links to some useful online lectures:

- <http://nptel.ac.in/courses/105106112/>
<https://www.youtube.com/watch?v=mtRR-5fzKo8>

5-12 13-20	TB1 5.4-5.18 6.1-6.19	Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages of Bolted and Welded Connections.	Chalk and Talk Video Lectures for some topics	20
---------------	-----------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------	----

Links to some useful online lectures:

- <http://nptel.ac.in/courses/105106112/13>

<ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=BcXZvfEA-e4 ➤ https://www.youtube.com/watch?v=9YZ_jE57YQQ 				
21-32	TB1 8.1-8.17	Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.	Chalk and Talk	15
Links to some useful online lectures: <ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106112/25 ➤ https://www.youtube.com/watch?v=Nj_HjNRE6-U 				
33-44	TB1 7.1- 7.4 8.1 -8.3	Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets. Design of Column Bases: Design of Simple Slab Base and Gusseted Base.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures: <ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106112/20 ➤ https://www.youtube.com/watch?v=v_G6JMj_yq8 				
45-56	TB1 9.1 - 9.7	Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams. Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]	Chalk and Talk	20
Links to some useful online lectures: <ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106112/36 ➤ 				
57-62	TB1 11.1-11.5	Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams	Chalk and Talk	10
Links to some useful online lectures: <ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=pcSvhMpoSDs 				

Text Books	
1.	N Subramanian., “Design of Steel Structures” (2016), Oxford University Press, New Delhi.
2.	Duggal S K., “Limit State Method of Design of Steel Structures”, Tata McGraw Hill, New Delhi Reference Books:
\Reference Books	
4.	Dayarathnam P, “Design of Steel Structures”, S Chand and Company Ltd., New Delhi.
5.	Kazim S M A and Jindal R S, “Design of Steel Structures”, Prentice Hall of India, New Delhi
6.	IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi

*

Syllabus for Internal Assessment Tests (IAT)

IAT #	Syllabus
IAT-1	Class # 01 – 20
IAT-2	Class # 21– 44
IAT-3	Class # 45– 62

* : See calendar of events for the schedules of IATs.

Course Outcomes
By the end of this course, students will be able to
1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behavior of structural steel
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

COGNITIVE LEVELS	
Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry.
PSO2	Analyze, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer.
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities.


CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions.	1	2	2	1	1	-	1	-	-	-	-	-	1	1	-	1	-
CO2	plastic behavior of structural steel	1	2	3	-	1	-	1	2	1	2	-	-	2	1	-	1	-
CO3	2. Understand the Concept of Bolted and Welded connections.	2	2	3	2	2	2	2	1	-	1	-	-	1	1	-	1	-
CO4	3. Understand the Concept of Design of compression members, built-up columns and columns splices.	3	1	2	1	-	2	1	-	-	-	-	-	1	1	-	1	-
CO5	4. Understand the Concept of Design of tension members, simple slab base and gusseted base.	4	2	2	-	-	2	-	-	-	-	-	-	2	1	-	1	-
CO6	5. Understand the Concept of Design of laterally supported and unsupported steel beams.	5	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1	-

Note : From time to time, assignments will be posted on

<https://sites.google.com/a/cmrit.ac.in/vibha-n-dalawai/>

CMR Institute of Technology, Bangalore			
Department(s): Civil Engineering			
Semester: 06	Section(s): A&B		
Highway Engineering		15CV63	Lectures/week: 04
Course Instructor(s): Divya Viswanath			
Course duration: 05 Feb 2018 – 25 May 2018			

Course Objectives

- Discuss the role of transportation and understand the highway planning and development stages.
- Discuss the surveys involved in highway alignment and design cross sectional elements, sight distance, horizontal and vertical alignment.
- Explain the different pavement materials and illustrate pavement design.
- Understand the specifications and construction methods of different pavements along with the significance of highway drainage.
- Recognise the highway user benefits, assess highway finance and carry out the associated economic analysis.

Prerequisites

- Basic knowledge of road network in India.

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-12	TB1: - 1.1-1.6, 2.2-2.5	MODULE – 1- PRINCIPLES OF TRANSPORTATION ENGINEERING : Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation –Central Road Fund, Indian Roads Congress, Central Road Research Institute HIGHWAY DEVELOPMENT AND PLANNING: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th twenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDC) Road development plan - vision 2021.	Chalk and Talk	20
Links to some useful online lectures: <ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105101087/2 				
13-25	TB1 3.1 - 3.5	MODULE-2 - HIGHWAY ALIGNMENT AND	Chalk and Talk	20

	4.1- 4.6	<p>SURVEYS: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.</p> <p>HIGHWAY GEOMETRIC DESIGN: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.</p>	Video Lectures for some topics	
<p>Links to some useful online lectures:</p> <p>➤ http://nptel.ac.in/courses/105101087/3</p>				
26-38	TB1 6.1 – 6.4 7.1 – 7.3	<p>MODULE 3- PAVEMENT MATERIALS: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous materials.</p> <p>PAVEMENT DESIGN: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.</p>	Chalk and Talk Video Lectures for some topics	20
<p>Links to some useful online lectures:</p> <p>➤ http://nptel.ac.in/courses/105101087/20</p> <p>➤ https://www.youtube.com/watch?v=L0x2DuYaXwk</p>				
39-51	TB1 6.5- 6.6 8.1 -8.2 8.4 -8.5	<p>MODULE 4- PAVEMENT CONSTRUCTION: Design of soil aggregate mixes by Rothfuch’s method. Uses and properties of bituminous mixes and cement concrete in pavement construction.</p> <p>Earthwork –cutting-Filling, Preparation of subgrade, Specification and construction of i) Granular Subbase, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads.</p>	Chalk and Talk Video Lectures for some topics	20
<p>Links to some useful online lectures:</p> <p>➤ https://www.youtube.com/watch?v=15PKCcRebpE</p> <p>➤ http://nptel.ac.in/courses/105104098/2</p>				
52-64	TB1 11.2 – 11.6 14.2 – 14.5	<p>MODULE 5 - HIGHWAY DRAINAGE: Significance and requirements, Surface drainage system and design- Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.</p> <p>HIGHWAY ECONOMICS: Highway user benefits, VOC using charts only- Examples, Economic analysis - annual cost method-Benefit Cost Ratio method- NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts.</p>	Chalk and Talk	20

Links to some useful online lectures:

➤ <http://nptel.ac.in/courses/105104098/45>

Text Books

- | | |
|----|------------------------------------------------------------------------------|
| 1. | S K Khanna and C E G Justo, “ Highway Engineering”, Nem Chand Bros, Roorkee. |
| 2. | L R Kadiyali, “Highway Engineering” , Khanna Publishers, New Delhi. |
| 3. | R Srinivasa Kumar, “Highway Engineering” , University Press. |

Reference Books

- | | |
|----|-----------------------------------------------------------------------------------------------|
| 7. | Relevant IRC Codes |
| 8. | Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi. |
| 9. | C. Jotin Khisty, B. Kent lal, “Transportation Engineering”, PHI Learning Pvt. Ltd. New Delhi. |

Syllabus for Internal Assessment Tests (IAT)^{*}

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19– 41
IAT-3	Class # 42– 64

* : See calendar of events for the schedules of IATs.

Course Outcomes**By the end of this course, students will be able to**

- Describe the importance of transportation and understand the highway planning and development stages.
- Conceptualize planning of the highway alignment and practice geometric design of highways.
- Interpret the characteristics of various pavement materials and concepts of pavement design.
- Describe the specifications and construction methods of different pavements along with the significance of highway drainage.
- Explain the highway user benefits, assess highway finance and carry out the associated economic analysis.

COGNITIVE LEVELS

Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend

L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in

	independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry.
PSO2	Analyse, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer.
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities.


CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Describe the importance of transportation and understand the highway planning and development stages.	1	1	-	1	-	-	-	-	1	1	-	-	-	1	-	-	1
CO2	Conceptualize planning of the highway alignment and practice geometric design of highways.	2	1	1	1	-	-	-	1	1	1	-	1	-	-	1	-	-
CO3	Interpret the characteristics of various pavement materials and concepts of pavement design.	3	1	1	1	1	-	-	1	1	1	-	-	-	1	1	-	-
CO4	Describe the specifications and construction methods of different pavements along with the significance of highway drainage.	4	1	-	1	-	-	1	1	1	-	-	-	-	-	-	1	1
CO5	Explain the highway user benefits, assess highway finance and carry out the associated economic analysis.	5	1	1	1	-	-	-	1	1	-	-	1	-	-	-	1	-

Note : From time to time, assignments will be posted on

<https://sites.google.com/a/cmrit.ac.in/divya-viswanath/>

CMR Institute of Technology, Bangalore			
Department(s): Civil Engineering			
Semester: 06	Section(s): A&B		
Water Supply & Treatment Engineering		15CV64	Lectures/week: 05
Course Instructor(s): Ms Bhavya K			
Course duration: 05 FEB., 2018 – 25 May 2018			

Course Objectives: After the completion of the course student will be able to

- Analyze the variation of water demand and to estimate water requirement for a community.
- Evaluate the sources and conveyance systems for raw and treated water.
- Study drinking water quality standards and to illustrate qualitative analysis of water.
- Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Prerequisites

- Water crisis
- Water and its need for treatment

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-10	TB2: - 5.1 – 5.8	MODULE-I Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period. Different methods of population forecasting -with merits and demerits. Numerical Problems.	Chalk and Talk	20
Links to some useful online lectures:				
➤ https://www.youtube.com/watch?v=pFKsj-c4k7M				
11-20	TB2 6.1 – 6.11	MODULE-II Water Treatment: Objectives, Treatment flow chart –significance of each unit Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques. Water quality characteristics: Physical, Chemical and Microbiological.	Chalk and Talk PPT for some topics	40
Links to some useful online lectures:				
➤ https://www.youtube.com/watch?v=5IK_fs3p7yc				
21-30	TB2 9.1 – 9.16 10.1 -10.11	MODULE-III Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers. Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism - theory of filtration, types of filters, slow sand, rapid sand and	Chalk and Talk	60

		pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system. Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.	PPT & video lectures for some topics	
--	--	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------	--

Links to some useful online lectures:

- <https://vimeo.com/31872280>
- <https://www.youtube.com/watch?v=ww1NIRDjtFM>

31-40	TB2 11.1 – 11.7 12.1 – 12.8	MODULE-IV Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration. Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.	Chalk and Talk Water treatment plant visit	80
-------	-----------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------	----

Links to some useful online lectures:

- <https://www.youtube.com/watch?v=9z14151ISwg>
- <https://www.youtube.com/watch?v=TELEY3OTXws>

41-51	TB2 14.1 – 14.7 15.1 – 15.14 16.1 – 16.5	MODULE-V Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures. Pumps: Types of pumps with working principles. Numerical Problems. Pipes: Design of the economical diameter for the rising main; Numerical Problems. Pipe appurtenances, Valves, Fire hydrants Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material. Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination. Visit to Intake structure, Water treatment plant and report working of each unit Design of water treatment plant units and distribution system with population forecasting for the given city	Chalk and Talk PPT for some topics	100
-------	---------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------	-----

Links to some useful online lectures:

- <https://www.youtube.com/watch?v=cvUa82Qb1Hg>

Text Books	
1.	S.K Garg; Water Supply Engineering, Twentieth edition.
2.	B.C Punmia; Environmental Engg-I, Second Edition, Laxmi Publications
Reference Books	
1.	Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000
2.	CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi

IAT #	Syllabus
IAT-1	Class # 01 – 21
IAT-2	Class # 21– 35
IAT-3	Class # 36– 51

* : See calendar of events for the schedules of IATs.

Course Outcomes	
By the end of this course, students will be able to	
➤	Predict population for water supply scheme and identify source of water and water demand
➤	Analyse drinking water quality data and check its suitability as per BIS
➤	Differentiate types of samples and describe different sampling procedures
➤	Design various components of water treatment plant and recommend suitable disinfection methods
➤	Identify different types of distribution system and testing water supply pipelines for leakage


COGNITIVE LEVELS	
Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry
PSO2	Analyze, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities

CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

CMR Institute of Technology, Bangalore			
Department(s): Civil Engineering			
Semester: 06	Section(s): A&B		
Solid Waste Management		15CV651	Lectures/week: 04
Course Instructor(s): Namitha B Nambiar			
Course duration: 05 Feb., 2018 – 25 May 2018			

Course Objectives

- Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
- Understand different elements of solid waste management from generation of solid waste to disposal.
- Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
- Evaluate landfill site and to study the sanitary landfill reactions.

Prerequisites

- Environmental Studies

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-8	TB1: - 3.1-3.3 4.1-4.2 6.1-6.8 8.1-8.7 10.1-10.7	Module -1 Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Collection: Collection of solid waste- services and systems, equipments, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- <http://nptel.ac.in/courses/120108005/5>
- <https://www.youtube.com/watch?v=OqTbxxIUH-g>

9-16	TB1 12.1-12.10	Module -2- Processing techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control ,Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).	Chalk and Talk Video Lectures for some topics	20
------	-------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------	----

Links to some useful online lectures:

- <http://nptel.ac.in/courses/120108005/10>
- <https://www.youtube.com/watch?v=FHSwy6Goej4>

17-24	TB1 11.1-11.13 14.1-14.9	Module -3- Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems. Sanitary landfilling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems	Chalk and Talk Video Lectures for some topics	25
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106056/14 ➤ https://www.youtube.com/watch?v=s-ps_0UFmfI 				
25-32	TB1 5.1-5.6	Module - 4- Sources, collection, treatment and disposal of :- Biomedical waste ,E-waste ,Hazardous waste and construction waste	Chalk and Talk Video Lectures for some topics	15
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/105106056/5 ➤ https://www.youtube.com/watch?v=iaDBE4-OIJs 				
33-40	TB1 13.1-13.7	Module -5 - Incineration -3Ts factor affecting incineration ,types of incinerations , Pyrolysis, design criteria for incineration Energy recovery technique from solid waste management	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				
<ul style="list-style-type: none"> ➤ http://nptel.ac.in/courses/120108005/10 ➤ https://www.youtube.com/watch?v=Ut3I7OIPFR8 				

Text Books

1. Tchobanoglous: Integrated Solid Waste Management, M/c Graw Hill,2013

Reference Books

12. Peavy and Tchobanoglous: Environmental Engineering, M/c Graw Hill,2013
13. S.K. Garg: Environmental Engineering – Vol II, Khanna Publications, 2009

*

Syllabus for Internal Assessment Tests (IAT)

IAT #	Syllabus
IAT-1	Class # 01 – 16
IAT-2	Class # 17– 30
IAT-3	Class # 31– 40

* : See calendar of events for the schedules of IATs.

Course Outcomes

By the end of this course, students will be able to

1. Analyse existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

COGNITIVE LEVELS

Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable

	development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry
PSO2	Analyze, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities


CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Analyse existing solid waste management system and to identify their drawbacks.	1,3,4	2	0	0	0	0	1	2	0	0	0	0	2	0	0	0	1
CO2	Evaluate different elements of solid waste management system.	1,3,4	2	0	0	0	0	1	2	0	0	0	0	2	0	0	0	1
CO3	Suggest suitable scientific methods for solid waste management elements.	2,3,5	2	0	0	0	0	1	2	0	0	0	0	2	0	0	0	1
CO4	Design suitable processing system and evaluate disposal sites.	3,5	2	0	0	0	0	1	2	0	0	0	0	2	0	0	0	1

Note : From time to time, assignments will be posted on

<https://sites.google.com/a/cmrit.ac.in/?tab=m3&pli=1>

CMR Institute of Technology, Bangalore		
Department(s): Civil Engineering		
Semester: 06	Section(s): A&B Elective	
Alternative Building Materials	15CV653	Lectures/week: 04
Course Instructor(s): N. Soundarya		
Course duration: 05 Feb., 2018 – 21 May 2018		

Course Objectives

1. Understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. Study the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
3. Study the alternative building materials in the present context.
4. Understand the alternative building technologies which are followed in present construction field.

Prerequisites

- Knowledge on basic Building Materials
- Basic knowledge on structural masonry
- Equipments used in constructions

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-12		Module -1 Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions	Chalk and Talk, PPT Video Lectures for some topics	15
Links to some useful online lectures: <ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=6rgn5V0Kon0 ➤ https://www.youtube.com/watch?v=Gn8N23_7FUU ➤ https://www.youtube.com/watch?v=pcjuXr8vQXA 				
13-25		Module - 2 Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units'	Chalk and Talk, PPT Video	15

		<p>characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.</p> <p>Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar.</p> <p>Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.</p>	Lectures for some topics	
<p>Links to some useful online lectures:</p> <ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=2fQH5AFdYrg ➤ https://www.youtube.com/watch?v=btajjXi0q9s 				
26-35		<p>Module -3 - Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes</p>	<p>Chalk and Talk, PPT</p> <p>Video Lectures for some topics</p>	10
<p>Links to some useful online lectures:</p> <ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=sVC_SEiP4IM 				
35-42		<p>Module -4 - Alternative Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down construction, Mivan Construction Technique.</p> <p>Alternative Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes</p>	<p>Chalk and Talk, PPT</p> <p>Video Lectures for some topics</p>	20
<p>Links to some useful online lectures:</p> <ul style="list-style-type: none"> ➤ https://www.youtube.com/watch?v=DPz61MWn8xw&list=PLVHf5WiLakt7vivSUMtA5CJa8SG3zcfhZ ➤ 				
43-52		<p>Module -5 - Equipment for Production of Alternative Materials: Machines for</p>	Chalk and Talk, PPT	10

	manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.	Video Lectures for some topics	
--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------	--

Links to some useful online lectures:

- <https://www.youtube.com/watch?v=UPQ17u09-rk>
- <https://www.youtube.com/watch?v=NfAzn50oIvs>

Text Books

1.	KS Jagadish, BV Venkatarama Reddy and KS Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International pub.
----	-----------------------------------------------------------------------------------------------------------------------------------------

Syllabus for Internal Assessment Tests (IAT) *

IAT #	Syllabus
IAT-1	Class # 1-20
IAT-2	Class # 21- 34
IAT-3	Class # 35– 52

* : See calendar of events for the schedules of IATs.

Course Outcomes

Course Outcomes: After studying this course, students will be able to:

1. Understand the construction management process.
2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
3. Fulfill the professional obligations effectively with global outlook

COGNITIVE LEVELS

Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of the construction industry
PSO2	Analyse, design and develop construction information details of simple structural elements and basic civil engineering systems.
PSO3	Support diverse tasks of construction project management as construction engineer.
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities.

CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;	1,2,3,4,5	3	3	3	3	1	2	3	1	-	-	2	3	1	-	2	3
CO2	Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.	2,3	3	3	2	2	-	-	2	-	-	-	-	3	-	3	-	2
CO3	Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.	2,3,4	3	2	3	2	1	3	3	1	-	-	-	3	2	3	2	3
CO4	Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.	1,2,3,4	3	3	3	2	-	3	3	1	1	-	2	3	2	3	2	3

Note : From time to time, assignments will be posted in the students ERP

Department(s): Civil en Engineering		
Semester: 06	Section(s): A&B	
WATER RESOURCES MANAGEMENT	15CV661	Lectures/week: 03
Course Instructor(s): Shivika Saxena, Karnapa Ajit		
Course duration: 05 Feb 2018 – 25 May 2018		

Course Objectives

This course will enable students:

- To judge surface and ground water resources.
- To address the issues of water resources management.
- To learn the principles of integrated water resources management.
- To understand the legal framework of water policy.
- To know the different methods of water harvesting.

Prerequisites

- Engineering Geology

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1-8	TB1: - 1.1-1.5, 9.1-9.4, 9.14	Module - 1 Surface and Ground water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium	Chalk and Talk Video Lectures and PowerPoint presentation for some topics	20
Links to some useful online lectures:				
➤ http://nptel.ac.in/syllabus/105105110/				
9-16	TB2 1.5	Module - 2 Water Resources Planning and Management: Necessity, System components, planning scales, Approaches, planning and management aspects, analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				
➤ http://nptel.ac.in/courses/105108081/				
17-24	TB4	Module -3 Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and	Chalk and Talk	20

Forms of Private Sector Involvement.				
Links to some useful online lectures:				
➤ https://www.youtube.com/watch?v=ZeIq-RPPL8U				
25-32	TB5 1.1-5.4	Module -4 Water Governance and Water Policy: Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal changes in Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				
➤ https://onlinecourses.nptel.ac.in/noc18_oe02/				
33-40	TB6	Module -5 Water Harvesting and Conservation: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area.	Chalk and Talk PowerPoint Presentation	20
Links to some useful online lectures:				
➤ http://nptel.ac.in/downloads/105101010/				

Text Books	
1.	K. Subramanya, “Engineering Hydrology”, Tata McGraw Hill Publishers, New Delhi.
2.	H.M. Raghunath, “Ground Water”, Wiley Eastern Publication, New Delhi.
3.	Daniel P. Loucks and Eelco van Beek, “Water Resources Systems. Planning and Management”, UNESCO Publication.
4.	Mollinga, P. et al, “Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.
5.	Singh, Chhatrapati “Water Rights in India,” Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi, 1992.
6.	Dhruva Narayana, G. Sastry, V. S. Patnaik, “Watershed Management”, CSWCTRI, Dehradun, ICAR Publications, 1997.
Reference Books	
14.	Lal, Ruttan. “ Integrated Watershed Management in the Global Ecosystem”. CRC Press, New York.
15.	Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.

Syllabus for Internal Assessment Tests (IAT) *

IAT #	Syllabus
IAT-1	Class # 01 – 16
IAT-2	Class # 17– 28

* : See calendar of events for the schedules of IATs.

Course Outcomes

By the end of this course, students will be able to

1. Assess the potential of groundwater and surface water resources.
2. Address the issues related to planning and management of water resources.
3. Know how to implement IWRM in different regions.
4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

COGNITIVE LEVELS

Cognitive level	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1	Apply knowledge and skills to perform diverse tasks of construction industry.
PSO2	Analyse, design and develop construction information details of simple structural elements and basic civil engineering systems
PSO3	Support diverse tasks of construction project management as construction engineer
PSO4	Pursue interests in specializations leading to bigger and diverse career opportunities

CORRELATION LEVELS

0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Assess the potential of groundwater and surface water resources.	1	2	-	-	1	-	-	1	-	-	-	-	3	-	-	-	-
CO2	Address the issues related to planning and management of water resources.	2	1	3	2	2	3	3	3	2	2	2	3	2	-	-	3	3
CO3	Know how to implement IWRM in different regions.	3	1	3	3	3	1	3	3	3	3	3	2	3	-	2	2	1
CO4	Understand the legal issues of water policy.	4	1	2	-	3	-	1	2	2	2	3	1	2	-	-	1	1
CO6	Select the method for water	5	3	2	3	1	1	-	2	-	1	2	-	3	2	3	-	1

