D Y PATIL
COLLEGE of
ENGINEERING & TECHNOLOGY
(AN AUTONOMOUS INSTITUTE)
KASABA BAWADA, KOLHAPUR

D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

Accredited by NAAC with 'A' Grade

Final year B. Tech. Syllabus

Department of Civil Engineering

(with effect from academic year **2023-24**)

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR

Teaching and Evaluation Scheme from Year 2023-24

Final Year B. Tech. Civil Engineering

SEMESTER-VII

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				Lecture Hours	Tutorial Hours	Practical Hours			Type	Max. Marks	Min. Marks for Passing	
1	201CEL401	PCC	Design of Concrete Structures	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201CEL402	PCC	Earthquake Engineering	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201CEL403 -407	PEC	Professional Elective -III	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201CEL408 -414	PEC	Professional Elective -IV	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	201CEL415 -416	OEC	Open Elective -II	3	1	-	4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
6	201CEP417	PCC-LC	Design of Concrete Structures Lab	-	-	4	2	75	ISE	50	20	
									ESE (OE)	25	10	
	201CEP418	PCC-LC	Earthquake Engineering Lab	-	-	2	1	25	ISE	25	10	
7	201CEP419-423	PEC-LC	Professional Elective -III Lab	-	-	2	1	25	ISE	25	10	
8	201CEP424	PROJ	Project Phase-I	-	-	4	2	100	ISE	50	20	
									ESE (OE)	50	20	
9	201CEP425	PROJ	* Internship (4-Weeks)	-	1	-	4	75	ISE	75	30	
			Total	15	2	12	26	800				
Summary			**Total Contact Hrs/week**	29			**Total Credits**		26	**Total Marks**		800

Dr. K. M. Mane
HOD Civil

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR

Teaching and Evaluation Scheme from Year 2023-24

Final Year B. Tech. Civil Engineering

SEMESTER-VIII

Students can choose any one track for Semester VIII from the following:

Track-I : Regular Academic Track
Track-II: Professional Training Track

Track-I : Regular Academic Track

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme			
				Lecture Hours	Tutorial Hours	Practical Hours			Type	Max. Marks	Min. Marks for Passing	
1	201CEL426	HSMC	Construction Techniques	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201CEL427-432	PEC	Professional Elective -V	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201CEL433-438	PEC	Professional Elective -VI	3	-	-	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201CEP439	HSMC-LC	Construction Techniques Lab	-	-	2	1	25	ISE	25	10	
5	201CEP440	PROJ	Project Phase-II	-	-	6	3	175	ISE	75	30	
									ESE (OE)	100	40	
Summary		Total		9	-	8	13	500				
		Total Contact Hrs/week		17			Total Credits		13	Total Marks		500

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR

Teaching and Evaluation Scheme from Year 2023-24

Final Year B. Tech. Civil Engineering

SEMESTER-VIII

Track-II : Professional Training Track

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation Scheme		
				L	T	P			Type	Max. Marks	Min. Marks for Passing
1	201CEP440	PROJ	Project Phase-II	-	-	6	3	175	ISE	75	30
									ESE (OE)	100	40
2	201CEL441	PROJ	Professional Training	-	-	20	10	325	ISE-1	50	20
									ISE-2	50	20
									ESE (OE)	225	90
Summary		Total		-	-	26	13	500			
		Total Contact Hrs/week		26			Total Credits		13	Total Marks	500

To join this Professional Training Track following are the prerequisite:

- Student can apply the Industrial Internship Track in following conditions –
  1. The student must have his/her attendance more than 75% by the end of semester – VII.
  2. The students must submit the willingness to this track by the end of term and before start of ESE of semester – VII.
  3. If student is selected in the company with PPO (Pre-placement offer) program through the college TPO.
  4. If student has an opportunity to work on the sponsored projects in industry/Research Institute for a period of 5-6 months.
  5. If student is getting onsite Internship offer for a period of 5-6 months.
  6. If student is getting Company Training program of 3-5 months.
- The company in which student wish to join for internship should be ISO Certified or Multi National Company (MNC).
- All formalities of getting offer letter/permission of working in Industry / Research Institute, etc. is to be done from the concerned authority in writing before starting of ESE of Sem – VII.
- Student should submit his/her application to the Professional Training Committee (PTC)

Revised Track-II
Dr. V. C. Mane

- Student should submit his/her application to the Professional Training Committee (PTC) along with details of communication done with the Industry/Research Institute, etc. for its approval.
- Professional Training Committee (PTC) comprises of HoD, Department T & P coordinator, T & P officer, faculty coordinator and two experts from Industry / Research Institute, etc.
- Professional Training Committee (PTC) will analyse the applications based on the communications done and the kind of work that is expected to be done by the Industry / Research Institute, etc., allocation of Industry supervisor, depth of the technical exposure, involvement in development of students, feasibility, etc. The Committee will accordingly approve the applications for Industrial Internship Track. The decision of the committee will be final.
- There should be a proper written communication between the Industry, TPO officer and department T & P Coordinator and faculty coordinator mentioning the details clearly as per the syllabus structure.
- There should also be an undertaking from the students mentioning completion of the Industrial Internship as per Industry / Research Institute, etc. requirements.
- Head of the department will appoint one faculty coordinator to coordinate committee work and manage all activities concerned with this track like assigning mentors to the students, organising IIC meetings, monitoring the entire process concerned with Industrial Internship Track, etc.
- For any exceptional cases, Professional Training Committee (PTC) will discuss and take decision which will be the final.

Following are the guidelines regarding Professional Training Track -

a) The evaluation of the Professional Training will be based on the work done by the student during the Onsite Internship/Company training/ PPO program/ Entrepreneurship / Research Internship, etc. for 3-6 months.
b) The faculty mentor assigned will be responsible for monitoring and assessment of the student on continuous basis. Students must present their work to the faculty mentor and Professional Training Committee (PTC) every 15 days in online mode in coordination with Industry Supervisor.
c) Every faculty mentor will be assigned workload of 2 hour per week for each student.
d) The ISE marks are to be given based on the continuous assessment done by the faculty mentor and Industry Supervisor.
e) Industry / Research Institute, etc. should provide certificate of completion of assigned task along with marks under ISE head before the conduct of ESE-OE exam.
f) The ESE (OE) is to be conducted in the Industry / Research Institute, etc. where the student is doing his work. The ESE (OE) will be conducted by both faculty mentor and Industry Supervisor.
g) The final credits will be earned by the student on completion of ISE and ESE (OE).

List of Professional Electives

SEM - VII

Professional Elective - III	
Code	**Course**
201CEL403	Design of Foundations and Retaining Structures
201CEL404	Air Pollution and Noise Pollution
201CEL405	Advanced Highway Engineering
201CEL406	Advanced Construction Methods
Professional Elective - IV	
201CEL408	Pre-stressed Engineering
201CEL409	Advanced Water & Wastewater Treatment
201CEL410	Design of Hydraulic Structures
201CEL411	Railway and Tunnel Engineering

SEM – VIII

Professional Elective - V	
201CEL427	Advanced Concrete Design
201CEL428	Sustainable Water & Sanitation System
201CEL429	Ground Water Hydrology
201CEL430	Total Quality Management and Management Information System
Professional Elective - VI	
201CEL433	Design of Bridges
201CEL434	Industrial Waste Management
201CEL435	River Engineering and Hydropower
201CEL436	Airport and Harbor Engineering

Final Year B.Tech (Sem-VII) Open Elective-II Subjects

Dept	Subject Name
CSE	i) Security and Privacy in Social Networks
	ii) Web Applications Development
ETC	i) Biomedical Instrumentation
	ii) Electronic Automation
Mech	i) Industrial Management (IM)
	ii) Computer Integrated Manufacturing System (CIMS)
Chem	i) Fuel Cell Technology
	ii) Industrial Behaviour and Practices
DS	i) Business Intelligence & Analytics.
	ii) Data Visualization and Storytelling.
AIML	i) AI For Everyone
	ii) Machine Learning with Python
Arch	i) Low Cost Housings
	ii) Sustainable Community Living

Course Plan

Course Title: Design of Concrete Structures	
Course Code: 201CEL401	**Semester: VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:
In the programme for civil engineers, a fundamental course on the design of reinforced concrete structures is offered. For the design of beams, slabs, columns, footings, and stairs, Limit State Method are introduced in this course. Lecture sessions and site visits will be used to convey the contents. Internal evaluation and the semester end exam will be used for the evaluation.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1. To impart the basic design philosophies followed in Reinforced Concrete Design and the stress-strain curve of concrete and steel.
2. To impart the concepts of design and detailing of RCC components under flexure, shear and bond using LSM.
3. To apply the design and detailing of RCC components for serviceability using LSM.
4. To apply the design and detailing of RCC Columns (rectangular and Circular) and Footing (Isolated and Combined) using LSM

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C401.1	Classify the different design philosophies as per the provisions made in IS-456-2000
C401.2	Analyze and design of beam components for shear and flexure
C401.3	Analyse and design of various reinforced concrete components for axial compression
C401.4	Analyse and design of slab, staircase, footing components for axial shear and flexure

Prerequisite:	Engineering Mechanics, Engineering Mathematics, Structural Mechanics

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and
Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C401.1	1	-	2	-	-	2	1	-	1	1	-	1	-	-	2
C401.2	1	1	3	-	-	1	-	-	2	2	-	1	-	1	3
C401.3	2	-	3	-	-	1	-	-	1	2	-	-	1	-	3
C401.4	2	-	3	-	-	1	-	-	1	2	-	-	1	-	3

Content	Hours
Unit 1. Introduction Stress- strain behavior of RCC, Permissible stresses in steel and concrete, Different design philosophies, various limits states, Characteristic strength and Characteristic load, Load factor, Partial safety factors.	6
Unit 2. Limit State of Collapse (flexure) Analysis and Design of Singly and Doubly Reinforced rectangular sections, singly reinforced T and L beams, Analysis and design of rectangular continuous beam, redistribution of moments.	10
Unit 3. Limit State of Collapse (Shear, Bond and Torsion): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length and Design for torsion. Limit state of serviceability: Significance of deflection, IS recommendations.	6
Unit 4. Design of Slabs and Staircase: Cantilever Slab, Simply supported One way slab, Two way slab with different support conditions as per IS:456-2000 Design of Simply Supported single flight stair and concept of dog-legged/open well staircase. (Numerical on single flight only)	6
Unit 5. Analysis and Design of Columns: Axially and eccentrically (uni-axial) loaded circular and rectangular columns, concept of biaxially loaded columns and Interaction diagram, Circular column with links and/helical reinforcement	6
Unit 6. Design of Footing: Isolated rectangular column footing with constant depth, stepped/ sloped section subjected to axial loads.	6

Text Books:

1	Karve and Shah, "Limit state theory and Design", Structures publications, Pune
2	A.K. Jain Reinforced Concrete Design – Limit state" Nem Chand brothers Roorkee
3	Sinha and Roy , "Fundamentals of Reinforced Concrete" S. Chand and company Ltd. Ram Nagar, New Delhi
4	B.C. Punmia , "Reinforced Concrete Design" Laxmi publications New Delhi

Reference Books:

1	P.C.Varghese , "Limit State Design of reinforced concrete" Prentice Hall, New Delhi
2	M. L. Gambhir , "Reinforced Concrete Design" Mc millan India Ltd. New Delhi

Codes:

1	IS 456-2000 - Plain and Reinforced Concrete - Code of Practice

Course Plan

Course Title: Earthquake Engineering	
Course Code: 201CEL402	**Semester : VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:
Course is comprised of basic concepts of earthquake engineering, vibration analysis, EQ resistant design, masonry structures etc.
Course also include modern earthquake resisting techniques.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To study basic concepts of Earthquake Engineering
2 To prepare mathematical modelling and do the seismic analysis.
3 To study design concepts with advance EQ resistant techniques.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C402.1	Understand the information of fundamental knowledge of EQ engineering.
C402.2	apply vibration and seismic analysis to real life problems.
C402.3	apply earthquake resisting design in civil engineering structures.
C402.4	Understand modern EQ resistant techniques.

Prerequisite:	Basic concepts of dynamics such as laws of motion, kinetics.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C402.1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	2
C402.2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
C402.3	3	3	3	-	-	-	-	3	-	-	-	-	2	-	3
C402.4	3	3	3	-	2	-	-	-	-	-	-	-	2	-	2

Content	Hours
Unit 1. Fundamentals of seismology – Basic terms, structure of earth, causes of an earthquake, plate tectonic theory, continental drift theory, elastic rebound theory, seismic waves, magnitude and intensity seismograph, strong motion earthquakes, Accelerogram.	6
Unit 2. Dynamics Fundamentals of theory of vibration, free and forced vibrations (harmonic loading) of single degree of freedom systems. Undamped and viscously damped vibrations, equations of motion and solution.	8
Unit 3. Response Spectrum and Seismic Forces Earthquake response spectrum, tripartite spectrum, construction of design response spectrum, evaluation of lateral loads due to earthquake on multi-storey buildings as per IS 1893– 2002 Part I.	8

Unit 4. Planning and Design Concepts Planning aspects, Load path, Stiffness and strength distribution, liquefaction and settlement, Behaviour of RC building, ductility and ductile detailing of beam and columns as per IS 13920.	7
Unit 5. Masonry Structures Behaviour of unreinforced masonry and reinforced masonry, RC bands, vertical reinforcement, openings, Provisions of I.S. 4326	7
Unit 6. Modern Earthquake Resisting (EQR) techniques Concept of Base Isolation, Elastomeric, Sliding, Combined. Seismic Dampers - Friction Dampers, TMD, Visco elastic dampers	4

Text Books:

1	S. K. Duggal, Earthquake Resistance Design of Structure –Oxford Uni. Press
2	A. K. Chopra, Dynamics of Structures- Theory and Applications to Earthquake Engineering – Prentice Hall Publications.

Reference Books:

1	D. J. Dowrick, Earthquake Resistant Structures –John Wiley Publication
2	Mario Paz , Structural Dynamics - CBS Publication

Codes:

1	IS 1893, Part-I, 2016 Criteria for Earthquake Resistant Design of Structures
2	IS 13920 - 2016 Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice

Course Plan

Course Title: Design of Foundation and Retaining Structures	
Course Code: 201CEL403	**Semester : VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The course focuses on the design of foundations and earth retaining structures. The behavior of these structures under serviceability and ultimate conditions is discussed in order to clarify the approaches, the calculation procedures. At the end of the course, the student must be able to make choices in relation to the definition of the type of foundation and earth retaining structure suitable for the design case under study, as well as to design the structure in compliance with the serviceability limit and ultimate limit states.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1. To explain the importance of various foundations and design different types of shallow and deep foundations.
2. To develop the skills necessary to analyse various types of retaining structures
3. To make choices in relation to the definition of the type of foundation and earth retaining structure

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C403.1	Analyze and design different types of shallow foundations
C403.2	Analyze and design pile foundations
C403.3	Analyze different types of retaining structures
C403.4	Explain the components and forces acting on RE walls.

Prerequisite:	Geotech Engineering, types of foundations

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C403.1	3	3	3	-	-	2	-	-	-	-	-	2	2	-	4
C403.2	3	3	3	-	-	-	-	-	-	-	-	1	2	-	4
C403.3	3	3	2	2	-	2	-	-	-	-	-	-	1	-	4
C403.4	3	1	1	1	-	-	-	-	-	-	-	1	-	-	3

Content	Hours
Unit 1. Shallow Foundations Types, proportioning of footing, Design of combined rectangular and combined trapezoidal footing.	7
Unit 2. Raft foundations Introduction, necessity and types of raft foundation, Design considerations, Analysis and Design of raft foundation by I.S. Code method.	7
Unit 3. Pile Foundation Classification of piles, Calculations of load capacity of single pile by static and dynamic formulae, Group action of piles, Design of pile caps for 3, 4 and 6 piles group.	7
Unit 4. Retaining Wall Introduction, Functions and types of retaining walls. Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions	7
Unit 5. Sheet Pile Walls and Cofferdams Types and uses of sheet piles, design of cantilever sheet pile walls in granular and cohesive soils, free earth support and fixed earth support method Coffer dams, types and uses of cofferdams	7
Unit 6. Reinforced Earth Retaining Walls Evolution and types, Components, forces acting, lateral stability analysis, failure modes, Construction methods	7

Text Books:

1	B.J. Kasmalkar, “Foundation Engineering”, Pune Vidyarthi Griha Prakashan
2	N. V. Naik, “Foundation Design Manual”, Dhanpat Rai and sons

Reference Books:

1	B.C. Punmia, “Soil Mechanics and Foundation Engineering” Laxmi Publications Pvt. Ltd., New Delhi
2	W. C. Teng, “Foundation Design”, Prentice Hall of India Pvt. Ltd., New Delhi
3	Poulos, H.G. and Davis, E.H. (1980). “Pile Foundation Analysis and Design”, John Wiley and Sons, New York.

D.Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY
KASABA BAWADA KOLHAPUR-416006
(An Autonomous Institute) B. Tech. Curriculum
Final Year B. Tech. Civil Engineering
SEM-VII (Academic Year 2023-24)

Course Plan

Course Title: Air Pollution & Noise Pollution	
Course Code: 201CEL404	**Semester: VII**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:
It introduces the sources of air and noise pollution, the effects of air and noise pollutants on human beings and environment. Also, it covers legislation and regulation; control technologies and future trends toward preventing air and noise pollution.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. Learn sources, causes and effects of air & noise pollution on humans, animals and environment.
2. Study the mechanisms and design of control equipment's for air & noise pollution
3. Understand the legal policies and measures for control of air & noise pollution.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C404.1	Explain the sources, causes and effects of air & noise pollution on humans, animals and environment.
C404.2	Explain the mechanisms and design of control equipment's for air & noise pollution
C404.3	Explain the legal policies and measures for control of air & noise pollution.

Prerequisite:	Environmental Studies, Environmental Engineering, Environmental Impact Assessment.

Course Articulation Matrix:
Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C404.1	3	3	-	-	-	-	3	-	-	-	-	-	-	-	2
C404.2	3	3	3	-	-	2	3	-	-	-	-	-	1	1	2
C404.3	3	3	-	-	-	2	3	2	-	-	-	-	-	1	2

Content	Hours
Unit 1. Introduction to Air pollution: Sources and types air pollutants, criteria air pollutants and their effects, Ambient air quality standards, Lapse rates, Stability of atmosphere, Inversion and its types, Plume behavior, Maximum Mixing Depth.	7
Unit 2. Dispersion of Air Pollutants: Air quality dispersion models, Gaussian dispersion model for point sources and line sources, applications and limitations of Gaussian model, Introduction to AERMOD and other soft wares	7
Unit 3. Control of Air Pollution: Control of air pollution from stationary and mobile sources, measures for effective control of air pollution in India, study of working principle and design of Particulate Control Equipments: Gravity settling chamber, Cyclone separator, Fabric filters, Electrostatic precipitator, Wet collectors.	7
Unit 4. Air Quality Management: Alternative fuels, Air quality index, National Air Quality Monitoring Program, Legislative measures, International treaties for control and mitigation of air pollution	6

Unit 5. Introduction to Noise pollution: Definition of noise, Sources of noise and classification, Effects of noise- effects on human health, auditory effects, physiological and psychological effects, effects on animals, effects on plants, effects on structures, Noise standards.	7
Unit 6. Control of Noise: Noise reduction at source, acoustical absorbing devices, Reduction at receiving end, Personal Protective Equipments for noise, Strategy for control of noise. Legal provisions for control of noise under Noise Pollution (Regulation and Control) Rules, 2000 and its amendments.	6

Text Books:

1	K. Wark, C.F. Warner and W.T. Davis Air Pollution Control: its Origin and Control, Addision-Wesley, (1998).
2	Stern A.C., ―Air Pollution Vol. I and II‖, Allied Publishers Limited, 1st Edition, 1994.
3	Noise Pollution and Control Strategy by S.P. Singhal, Narosa Publishing House, 2005

Reference Books:

1	Nevers N., "Air Pollution control Engineering" McGraw-Hill, New York, 2nd edition, 1995
2	Fundamentals of Air Pollution by Richard W. Boubel, D. L. Fox, D. B. Turner and A. C. Stern, Reed Elsevier India Pvt. Ltd., New Delhi
3	Noise Pollution – S. K. Agrawal- APH Publishing corporation, New Delhi. 2009

Codes:

1	IS 4954: 1968
2	IS 5182: 1999

Course Plan

Course Title: Advance Highway Engineering	
Course Code: 201CEL405	**Semester: VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

Highway Engineering is an engineering discipline branching from civil engineering that involves the planning, design, construction, operation, and maintenance of roads, bridges, and tunnels to ensure safe and effective transportation of people and goods with advanced methods & technologies.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 Evaluation and prediction of pavement performance, to learn Ranking and economic optimization of pavement maintenance and rehabilitation and management.
2 Study of Systems approach to Transportation Planning
3 Study of Transit and Non-Auto Modes & Road safety audit.
4 Introduction to applications of GIS in transportation engineering.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C405.1	Design alternate pavement management systems based on life cycle cost analysis
C405.2	Define different system approach to Transportation Planning
C405.3	Understand the Transit and Non-Auto Modes & Road safety audit.
C405.4	Explain the applications of GIS in transportation engineering

Prerequisite:	Highway engineering-I, Engineering Survey

Course Articulation Matrix:
Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C405.1	3	2	-	-	-	1	-	-	-	-	1	2	1	-	3
C405.2	3	-	-	-	-	1	-	-	-	-	-	2	-	-	2
C405.3	3	1	-	-	-	1	-	-	-	-	-	2	1	-	3
C405.4	3	-	-	-	-	1	-	-	-	-	-	2	-	-	2

Content	Hours
Unit-1 Pavement Management System: Components of PMS and their activities; Major steps in implementing PMS; Pavement Maintenance Management Components of Maintenance Management and Related Activities – Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies	7
Unit-2 TSM Philosophy: Systems approach to Transportation Planning; Long Term Strategies and Short term Measures; TSM actions – Objectives and Philosophy; Relevance of TSM actions to Indian Urban Context. Broad spectrum of TSM actions.	7
Unit-3 Transit and Non-Auto Modes of Transportation : Preferential Treatment to High Occupancy Vehicles; Car Pooling; Transit Service Improvement Measures; Transit management Improvement Measures; Transit and Para Transit Integration; Para-transit Role in Urban Areas; Multi-modal coordination. Measures to Promote Non-Auto modes: Pedestrianisation; Bicycle Transportation – Advantages; planning Bicycle facilities – Class I, Class II and Class III Bikeways; Junction Treatments for Cycle Tracks; LOS criteria for Pedestrian and Bicycle facilities	7

Unit-4 Advanced Transit Technologies: Conventional and Unconventional Systems; Rapid Transportation Systems; New Technologies: LRT, Automated Highways, Hovercraft; System characteristics and suitability.	6
Unit-5 Application of GIS in Transportation Engineering: Intelligent information system for road accessibility study, GIS data base design for physical facility planning, Decision support systems for land use planning. Application of GIS in Transportation Engineering – II - GIS applications in environment impact assessment, GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation.	8
Unit-6 Crash Reconstruction: Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.	7

Reference Books:

1	Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
2	Ogden, K.W. Safer Roads: A Guide to Road Safety Engineering. Avebury Technical, 1996
3	Ralph Hass, Ronald Hudson and Zanieswki, “Modern Pavement management”- Krieger Publications.
4	W. Ronald Hudson, Ralph Haas and Waheed Uddin, ‘Infrastructure Management’- Mc Graw Hill
5	Haas and Hudson , W. R. Pavement management systems –McGraw Hill publications
6	Transportation System Management Notes, S.R.Chari, REC, Warangal
7	Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill
8	The Bicycle Planning, Mike Hudson, Open Books, UK
9	GIS for Urban & Regional Planning, Scholten & Stillwen 1990, Kulwer Academie Publisher.
10	GIS A Management, Perspenfi Stan Aronoff, WDL Publisher
11	GIS By Stonffer
12	Proceedings of International Conference on Structural Design of Asphalt Pavements.
13	Proceedings of North American Conference on Managing Pavement.
14	Towards Safe Roads in Developing country, TRL – ODA, 2004

Course Plan

Course Title: Advanced Construction Methods	
Course Code: 201CEL406	**Semester : VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

As a prerequisite to this course, it is expected that students have already learnt some basic concepts, principles and important aspects of construction technology. Now in this course of 'Advance Construction methods', some advance aspects of construction technology will be covered. In today's times the construction activities is undergoing lots of changes/developments due to internal and globalised market demands of quality and faster completion of project works using modern techniques and through mechanized construction.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1. Summarize the construction of underwater, underground construction and bridge construction.
2. Knowledge of prefabrication and pre engineering construction method used in construction practice.
3. Study the various uses of cofferdams, caissons and piles for foundation construction.
4. Knowledge of formworks and earth retaining structures.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C406.1	Understand underground, underwater and bridge construction methods.
C406.2	Follow and apply prefabrication and pre engineering construction method.
C406.3	Use cofferdams, caissons and piles for foundation construction.
C406.4	Familiarise with formworks and earth retaining structures.

Prerequisite:	Geotechnical design, Building Construction and materials

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C406.1	3	1	-	1	-	-	-	-	-	-	-	2	1	-	2
C406.2	3	1	-	1	-	-	-	-	-	-	-	2	1	-	2
C406.3	3	1	-	1	-	-	-	-	-	-	1	2	-	1	2
C406.4	3	2	-	1	-	-	-	-	-	-	1	2	-	1	2

Content	Hours
Unit 1. Underwater and Underground Construction Shaft sinking, Tunnel driving in hard and soft strata, Surge chambers - Design criteria, loads, assumptions, Types of surge chambers. Underwater Construction - Problems encountered, Underwater drilling, blasting, concreting and welding, Underwater structural concrete walls. Protection of structures against attack by ground.	7
Unit 2. Bridge Construction Launching of steel, Pre-stressed, Precast bridges. Site erection methods: Side showing method for road, railway, bridges. End launching Using cranes and gantries, Cantilever method, Floatation method, Incremental launching for concrete girders, Dismantling for maintenance, repairs and inspection of bridges. Testing of bridges.	7
Unit 3. Pre-fabricated Construction and Pre- Engineering steel building Types, Standardization of components, Size and economy, Fabrication techniques, Transportation, Erection, Jointing. Introduction to pre-engineered buildings: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered buildings.	7
Unit 4. Coffer Dams, Caissons and Pilling Techniques Land cofferdams, Soldier beam and horizontal sheeting techniques, Design considerations, Sinking rate, Open caissons, Pneumatic caissons. Machine bored caissons. Drop caissons. Details of design and construction.	7
Unit 5. Piles and Pilling Techniques Pilling – behaviour of single pile and a group of piles during driving, Under loads-ultimate loads on driven and cast in situ piles, Construction details of precast piles, Pre-stressed piles, Steel piles, Friction piles. Driven piles, Bored piles, Large diameter bored piles, Negative and positive friction.	7

Unit 6. Modern Formwork and Earth Retaining Structures **a) Formwork** Design and requirement of different types of formwork. Types of formwork: Timber, steel, aluminum, scaffoldings, slip form, jump form, modular shuttering, Mivaan, Doka shuttering. Removal of formwork, Cost aspect of formwork. **b) Earth retaining structures** Types of Earth Retaining Structures: Gravity walls, Cantilever walls, Counterfort wall, Crib wall, Gahion wall, Sheet Pile walls, Diaphragm walls, Reinforced Earth walls	7

Text Books:

1	G. A. Leonards, "Foundation Engineering" Mcgraw Hills Co.Ltd.
2	Vijaya Singh, "Wells and Caissons", New Chand & Bros, Roorkee

Reference Books:

1	Wynn, "Formwork Design and Construction"
2	Peurifey RI, "Construction Planning Equipment's and Methods"
3	Stubbs, "handbook of heavy Construction"
4	Dr. P. Purushothamma Raj, "Ground Improvement Techniques", Laxmi Publications.

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Course Plan

Course Title: Pre-stressed Engineering	
Course Code: 201CEL408	**Semester: VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description: Basic concept of pre-stressed concrete, analysis and design of pre-stressed beams and loss in pre-stress

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 To know the basic materials properties of pre-stressed concrete
2 To understand fundamental principal of pre-stressing
3 Analysis of loss in pre-stressed concrete
4 Analysis and design of pre-stressed concrete members

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C408.1	Explain basic properties of pre-stressed concrete constituents and analyze different methods.
C408.2	Evaluate short term and long-term losses and deflections in pre-stressing structures.
C408.3	Analyze stresses in anchorage zones and design the end blocks as per relevant I.S. codes 1343: 2012
C408.4	Design different types of pre-stressed concrete beams.

Prerequisite:	Engineering Mechanics, Engineering Mathematics, Structural Mechanics

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C408.1	1	-	2	-	-	2	1	-	1	1	-	1	-	-	2
C408.2	1	1	3	-	-	1	-	-	2	2	-	1	-	1	3
C408.3	2	-	3	-	-	1	-	-	1	2	-	-	1	-	3
C408.4	2	-	3	-	-	1	-	-	1	2	-	-	1	-	3

Content	Hours
Unit 1. Introduction Introduction: Historic development- General principles of prestressing pre-tensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of prestressing- Materials- high strength concrete and high tensile steel their characteristics Methods and Systems of prestressing: Pretensioning and Posttensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.	6
Unit 2. Analysis of Beam Analysis of sections for flexure- beams prestressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams- analysis of PSC beams of rectangular and I sections- Kern line – Cable profile and cable layout using stress, load balancing method and C line method under all loading conditions	6
Unit 3. Loss of Pre-stress Losses in Prestress - elastic deformation, creep, shrinkage, friction, anchorage slip, relaxation in steel for Pre & Post tensioned members.	6

Unit 4. Deflection of Pre-stressed Members Importance of control of deflection, factors influencing deflections, short term deflection of uncracked members, prediction of long deflections, deflection of cracked members, requirement of various codes of practise.	6
Unit 5. Design of End Block Transmission of pre-stress in pretensioned members, transmission length, anchorage stress in post-tensioned members. Bearing stress and bearing tensile force-stresses in end blocks-Methods, IS Code, provision for the design of end block reinforcement, design of bearing plates.	8
Unit 6. Design of Pre-stressed Beam Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of pre-stressing force and eccentricity, limiting zone of pre-stressing force cable profile.	8

Text Books:

1	Krishna Raju N. "Pre-stressed Concrete", Tata McGraw.
2	Ramamrutham S. "Pres-stressed concrete" Dhanpat rai Publication
3	Ned H Burns and T.Y. Lin, ―Prestressed Concrete Structures, Wiley India.

Reference Books:

1	Vanakudre S.B. & Ashish Yeligar, ―Pre-stressed Concrete Materials, Analysis & Design‖, Khanna Publishers, New Delhi.

I.S. Codes:

1	IS 1343: 2012 ―Code of Practice for Pre-stressed Concrete.

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Course Plan

Course Title: Advanced Water & Wastewater Treatment	
Course Code: 201CEL409	**Semester: VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:
The capacity to provide water of a higher quality than that produced by traditional treatment methods, advanced water and wastewater treatment procedures are becoming more and more popular. Students who take this course will learn how to create cutting-edge systems for treating wastewater and water. The subject combines engineering and science (chemistry, physics, and biology) in a variety of ways, including by using engineering and design principles to solve problems and by learning from nature.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To discuss the need for enhanced water and wastewater treatment and an evaluation of conventional treatment.
2 To impart thorough understanding of developments in physical, chemical, and biological processes that are helpful for the treatment of water and wastewater
3 To develop the skills necessary to analyse and create water and wastewater treatment systems, including independent judgement and critical thinking

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C409.1	Describe and apply new developments in physical, chemical and biological processes.
C409.2	Analyze the physical, chemical, and biological processes used in water and wastewater treatment.
C409.3	Design the advanced water and wastewater treatment systems.

Prerequisite:	Environmental Engineering

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C409.1	3	2	2	-	-	2	3	-	-	-	-	2	1	1	3
C409.2	3	2	2	-	-	2	3	-	-	-	-	2	1	1	4
C409.3	3	3	3	3	-	2	3	-	-	-	-	2	1	1	3

Content	Hours
Unit 1. Need & Basics of Advanced Treatment Review of conventional water treatment, need for advanced water and wastewater treatment, Technologies used for advanced treatment, reclamation and reuse of wastewater. Reactors used for the treatment, Mass-Balance Analysis, Modeling Treatment Process Kinetics.	7
Unit 2. Chemical Unit Processes Chemical coagulation, Chemical precipitation, Chemical Disinfection, Chemical oxidation, Chemical neutralization, scale control and stabilization.	7
Unit 3. Filtration and Adsorption Depth filters, Surface filtration, Membrane Filtration processes, Types of adsorbents, Fundamentals of Adsorption, Development of Adsorption Isotherms, Activated Carbon Adsorption Kinetics.	7
Unit 4. Gas Stripping and Ion Exchange Analysis of Gas stripping, Design of stripping Towers, Application Ion Exchange materials, Reactions, Exchange capacity of resins, Application, Operational consideration.	7
Unit 5. Advanced Oxidation processes and Disinfection Process Theory of Advanced Oxidation, Technologies used, Applications, operational problems, Advanced Disinfection process	6

Unit 6. Natural Treatment Systems Constructed wetland and aquatic treatment systems; Types- free water surface and subsurface constructed wetlands, selection of plants, removal mechanisms, applications, design procedure for constructed wetlands, Management of constructed wetlands.	6

Text Books:

1	Wastewater Engineering treatment and reuse – Metcalf & Eddy, Inc., George Tchobanoglous, Franklin Burton, H. David Stensel, Tata McGraw-Hill Education, 2002

Reference Books:

1	Environmental Engineering- Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, McGraw-Hill, 1985
2	Physicochemical processes: for water quality control – W. J. Weber, Wiley Interscience, 1972
3	Wastewater Treatment for Pollution Control – Soli J. Arceivala and Shyam R. Asolekar, Tata McGraw-Hill Education, 2017
4	Theory and Practice of Water and Wastewater Treatment – Ronald Droste, John Wiley, 2019
5	Manual- Constructed Wetlands Treatment of Municipal Wastewaters- USEPA, 2000

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Course Plan

Course Title: Design of Hydraulic Structures	
Course Code: 201CEL410	**Semester: VII**
Teaching Scheme: L-T-P :3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:
Design of Hydraulic structures forms an integral part of water resources engineering projects. It includes selection of site for a particular type of dam, design and constructional features of Gravity dam, Embankment dams, and Arch dams, Canal Structures , Spillway ,Gates ,River training works.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 To impart knowledge regarding the design of the various minor irrigation structures.
2 To convey the knowledge on the causes of failure, design criteria and stability analysis of different types of dams, canal structures , river training works.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C410.1	apply the knowledge related to hydraulic structures.
C410.2	select and design suitable hydraulic structures.
C410.3	apply the knowledge of canal design principles for various canal structures.
C410.4	analyze and design the appropriate river training works

Prerequisite:	Water Resource Engineering I

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
C410.1	3	-	-	-	-	-	-	-	2	-	2	-	-	-	3
C410.2	3	-	2	-	-	-	-	-	2	-	2	2	2	1	3
C410.3	3	1	2	-	-	-	-	-	2	-	-	2	2	1	4
C410.4	3	-	2	-	-	-	-	-	2	-	2	2	2	-	3

Content	**Hours**
Unit 1: Dams Types of Dams, Choice of dam, various components of dam. Gravity dam details: Forces acting on Gravity dam, Joints, water-seals and galleries. Elements of Earth Dam: Basic design consideration, causes of failures, piping and its prevention in Earthen dam, Arch dam. Instrumentation in Dams.	8
Unit 2: Spillway and Gates Determination of Spillway capacity, Principles of design of Ogee Spillway, Energy dissipaters, Forces acting on Gates.	7
Unit 3: Canal Irrigation and Design of Canal Structures Economics of Canal lining, Determination of Canal capacity, Design of lined canal. Aqueduct, Canal Fall, Siphon, Sarda Type Fall, Cross Regulator Navigation locks and its components. **Introduction to Canal Automation.**	7

Unit 4: Preliminary Sediment Transport Theory applied to Irrigation Canal Critical tractive force, regimes of flow, resistance of bed forms, suspended and bed load, its effect on channel design. Design of stable channels in alluvium, the regime method, semi theoretical approach, cross-section of irrigation canals. **Introduction to Pipe Network Irrigation: Necessity and benefits**	7
Unit 5: Diversion Head Works Selection of sites, layout of the work, types of weirs and barrages, design of subsurface flow, safety against piping and uplift, Bligh, Lane, and Khosla's Theories, design of weirs on permeable foundations.	7
Unit 6: River Training Works Hydraulics of alluvial rivers, meandering, aggradations and degradation, river training, necessity, river training works and bank protection, various measures and their design and construction principles.	6

Text Books:

1	Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers Delhi, 2007.
2	Modi, P.N.,Irrigation, Water Resource and Water Power Engineering, Standard Book House, Delhi, 2008
3	Punmia B.C. Ashok K Jain, Arun K Jain, B. B. L Pande, Irrigation and Water Power Engineering, Laxmi Publications (P) Ltd. 2010

Reference Books:

1	Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, 2010.
2	Asawa. G.L. Irrigation and Water Resources Engineering, New Age International, 2000
3	Sahasrabudhe S.R., Irrigation Engineering & Hydraulic Structures, S.K. Kataria& Sons, 2013

Course Plan

Course Title: Railway and Tunnel Engineering	
Course Code: 201CEL411	**Semester: VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:
It is the branch of Civil engineering deals with planning, design, construction, operation-maintenance of facilities providing for the railway and tunnel Engineering.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To introduce the fundamentals and advances in the area of railway Engineering.
2 To Understand Fundamentals and purpose of tunnels.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C411.1	Apply the knowledge of railway track components, materials and fixtures and fastenings.
C411.2	Solve problems of railway track geometrics, train resistance, points and crossings.
C411.3	Learn about signalling and control system , advancement in Railway Engineering
C411.4	Study various component parts & processes to run tunnel engineering system
C411.5	Study the concept of tunnelling methods.

Prerequisite:	Transportation Engineering

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C411.1	3	-	-	-	-	1	-	-	-	-	-	1	1	-	2
C411.2	3	2	2	-	-	1	-	-	-	-	-	1	1	-	3
C411.3	3	-	-	-	-	-	-	-	-	-	-	1	1	-	2
C411.4	3	-	-	-	-	-	-	-	-	-	-	1	1	-	2
C411.5	3	-	-	-	-	-	-	-	-	-	-	1	1	-	2

Content	Hours
Unit 1. Introduction to Railway Engineering Development of railways in India - Components of a permanent way and its functions - Rails, Gauges and its selection, Sleepers, Ballast, Formation, Rail fittings and fastenings - Coning of wheels Defects in rails: creep and shift in rails	6
Unit 2. Geometric Design Geometric design: Alignment, gradient, horizontal curves, super elevation, design problems on above. Points & Crossing: Terms used, standard points and crossings, Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing. design of simple turnout various types of track junctions.	8
Unit 3. Railway Stations and Signalling Railway stations: requirements, facilities, classifications, platforms, and types of yards. Signal Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system, System for Controlling Train Movement –Interlocking, Anti Collision Device Modernization of railways- Metro rail, mono rail, Bullet Train, High Speed Train	7

Unit 4. Tunnel Engineering General, advantages and disadvantages of tunnelling, Advantages and disadvantages of open cuts, Classification of tunnels, Shapes of tunnels, Comparison of by passing Alternative s Tunnel, Open cut, bridge and surface road, Size of tunnels, Problems in tunnelling.	6
Unit 5. Alignment of Tunnel Alignment of a tunnel, Alignment restraints, Environmental considerations Investigations for tunnel site – Geotechnical Exploration in Tunnelling, Investigations before planning, Investigations at the time of planning, Investigations at the time of construction. Setting out of tunnel - Setting out tunnel on ground surface, Transfer of centre line from surface to underground, Underground setting out, Underground levelling,	7
Unit 6. Tunnelling Methods Tunneling Methods- Types and purpose of tunnels; factors affecting choice of excavation technique; Methods - soft ground tunneling, hard rock tunneling, Tunnel lining. Introduction of lighting, ventilation and drainage in tunnel.	8

Text Books:

1	Arora, S. P. and Saxena, S. C, "A Textbook on Railway Engineering", Dhanpat Rai Publications (P) Ltd., New Delhi
2	R. Srinivasan, "Harbour, Dock And Tunnel Engineering" Charotar Publishing House Pvt. Ltd.

Reference Books:

1	M M Agarwal, "Railway Works Engineering", Prabha & Co. Delhi
2	Chandra Satish and Agrawal M.M., "Railway Engineering", ISBN: 978-0198083535, Oxford University Press, New Delhi.
3	Asheesh Kumar "Tunnel Engineering" Vayu Education of India
4	Subash C. Saxena "Tunnel Engineering" Dhanpat Rai Publications (P) Ltd.

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Course Plan

Course Title: Design of Concrete Structures Lab	
Course Code: 201CEP417	**Semester: VII**
Teaching Scheme: L-T-P: 0-0-4	**Credits: 2**
Evaluation Scheme: ISE Marks: 50	**ESE Marks: 25 (OE)**

Course Description:

The Structural Design and Drawing course provide a comprehensive understanding of structural engineering principles and techniques, including analysis, design, and drawings of structural systems.By the end of the course, students will be prepared for careers in structural engineering.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To apply a holistic approach of analysis and design to RCC building.
2. To use codal provisions for the reinforcement detailing of various components of RCC Structures.
3. To use analysis and design software's.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C417.1	Understand all the RCC structural drawings.
C417.2	Prepare structural drawings and reinforcement details of RCC Structure.
C417.3	Design of RCC Structure using design software.
C417.4	Apply codal provisions as per IS 456, IS 13920, & SP16 for design and drafting of RCC structure.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C417.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C417.2	3	2	-	-	-	-	-	-	-	-	-	-	2	2	3
C417.3	2	2	-	-	3	-	-	-	-	-	-	-	-	2	4
C417.4	1	-	-	-	-	-	-	3	-	-	-	-	-	-	3

LIST OF EXPERIMENTS /ACTIVITY

Sr. No.	Title	Hours
Term work shall consist of detailed design & drawing of the following R.C. structures by Limit State Method.		
1	**Residential G + 1 storied building.** (Minimum 60 sq.mt. per floor). Drawings prepared shall indicate ductility details as per the provisioning IS:13920. (This Project should be in a group of 2-3 students)	30
2	**Analysis and design of RCC framed structure using software.** (It shall include Preparation of model, Application of loads, and generation of detailed analysis and design report.)	30

Textbooks:

1.	Shaha Karve, "Limit state theory and Design" Structures publications, Pune
2.	Sinha and Roy, "Fundamentals of Reinforced Concrete" S. Chand and company Ltd. Ram Nagar, New Delhi.
3.	B.C. Punmia, "Reinforced Concrete Design" Laxmi publications New Delhi.

Reference Books:

1	N. Krishna Raju, "Structural Design and Drawing (Reinforced Concrete and Steel") Universities press (India) Private limited, Himyatana nagar, Hyderabad.

Codes:

1	IS 456
2	IS 13920
3	SP 16

Course Plan

Course Title : Earthquake Engineering Lab	
Course Code : 201CEP418	**Semester : VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme: ISE Marks: 25	**ESE Marks : N.A.**

Course Description:

Course comprised activities and assignments on the basic concept, analysis and design of earthquake resisting structure with modern techniques.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To study basic concepts of Earthquake Engineering
2. To prepare mathematical model, seismic analysis and the design with EQ resistant techniques.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C418.1	Explain the information of fundamental knowledge of EQ engineering.
C418.2	Apply the knowledge of EQ to make a model of earthquake resisting structure

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C418.1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	2
C418.2	3	3	2	-	2	-	-	2	-	-	-	-	2	-	2

LIST OF EXPERIMENTS /ACTIVITY (Any 12 of below)

Sr. No.	Title	Hours
1	Assignment on Elements of Seismology.	02
2	Quiz on Elements of Seismology.	02
3	Assignment on Dynamic problems.	02
4	Mathematic modelling	02
5	Assignment on Seismic Analysis	02
6	Calculation of Seismic Forces in Existing Structure	02
7	Site visit on EQR Planning	02
8	Site Visit on Ductile Detailing	02
9	Quiz on EQR Planning	02
10	Assignment on Masonry Structures	02
11	Quiz on Masonry Structures	02
12	Model making of Masonry Structures	02
13	Assignment on Masonry Structures	02
14	Quiz on Masonry Structures	02
15	Model making of Masonry Structures	02

Text Books:

1	S. K. Duggal, Earthquake Resistance Design of Structure –Oxford Uni. Press
2	A.K. Chopra , Dynamics of Structures- Theory and Applications to Earthquake Engineering – Prentice Hall Publications.

Reference Books:

1	D.J. Dowrick, Earthquake Resistant Structures –John Wiley Publication
2	Mario Paz , Structural Dynamics - CBS Publication

Codes:

1	IS 1893, Part-I, 2016 Criteria for Earthquake Resistant Design of Structures
2	IS 13920 - 2016 Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice

Course Plan

Course Title : Design of Foundation and Retaining Structures Lab	
Course Code : 201CEL419	**Semester : VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks : N.A.**

Course Description:

The course focuses on the design of foundations and earth retaining structures. The behavior of these structures under serviceability and ultimate conditions is discussed in order to clarify the approaches, the calculation procedures.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To explain the importance of various foundations and design different types of shallow and deep foundations.
2. To develop the skills necessary to analyse various types of retaining structures
3. To make choices in relation to the definition of the type of foundation and earth retaining structure

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C419.1	Analyze and design different types of shallow foundations
C419.2	Analyze and design pile foundations
C419.3	Analyze different types of retaining structures

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C419.1	3	3	3	-	-	2	-	-	-	-	-	2	2	-	4
C419.2	3	3	3	-	-	-	-	-	-	-	-	1	2	-	4
C419.3	3	3	2	2	-	2	-	-	-	-	-	-	1	-	4

LIST OF EXPERIMENTS /ACTIVITY

Sr. No.	Title	Hours
1	Design and Detailed drawing of combined rectangular footing	4
2	Design and Detailed drawing of combined trapezoidal footing	4
3	Design and Detailed drawing of Raft Foundation	4
4	Design and Detailed drawing of Pile Foundation	6
5	Design and Detailed drawing of cantilever type of retaining wall	6
6	Assignment based on Sheet Pile Walls and Cofferdams	2
7	Site visit for any Retaining Structure	4

Text Books:

1	B.J. Kasmalkar, “Foundation Engineering”, Pune Vidyarthi Griha Prakashan
2	N. V. Naik, “Foundation Design Manual”, Dhanpat Rai and sons

Reference Books:

1	B.C. Punmia, “Soil Mechanics and Foundation Engineering” Laxmi Publications Pvt. Ltd., New Delhi
2	W. C. Teng, “Foundation Design”, Prentice Hall of India Pvt. Ltd., New Delhi
3	Poulos, H.G. and Davis, E.H. (1980). “Pile Foundation Analysis and Design”, John Wiley and Sons, New York.

Codes:

1	IS 456-2000

Course Plan

Course Title : Air Pollution & Noise Pollution Lab	
Course Code : 201CEL420	**Semester: VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks : NA**

Course Description:

It deals with the identification of sources of air and noise pollution, the effects of air and noise pollutants on human beings and environment. Also, it covers legislation and regulation; control technologies and future trends toward preventing air and noise pollution.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. Learn the quality parameters control techniques with respect to air & noise pollution.
2. Learn the issues in the regions and suggest proper solutions with respect to air & noise pollution.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C420.1	Determine the quality parameters with respect to air & noise pollution.
C420.2	Analyze different control equipments with respect to air & noise pollution.
C420.3	Analyse the problems identified and give a solution with respect to air & noise pollution.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C420.1	3	3	3	2	2	2	3	-	2	-	-	-	-	-	4
C420.2	3	3	3	2	2	2	3	-	2	-	-	-	-	2	4
C420.3	3	3	3	-	-	-	3	-	2	-	-	-	2	2	4

LIST OF EXPERIMENTS/ACTIVITIES

Sr. No.	Title	Hours
1	Air Pollutants and their effects	2
2	Study Standard Air Levels	2
3	Study Standard Noise Levels	2
4	Study working of Respirable Dust Sampler (RDS)	2
5	Air Quality Monitoring in Residential Sector	2
6	Air Quality Monitoring in Commercial Sector	2
7	Air Quality Monitoring in Industrial Sector	2
8	Study and working of Sound Level Meter	2
9	Noise Levels in Residential Sector	2
10	Noise Levels in Commercial Sector	2
11	Noise Levels in Industrial Sector	2
12	Visit any PUC and analyze vehicular emission data.	2
13	Case Study- Identify location nearby facing air pollution and give a proper solution.	2
14	Case Study- Identify location nearby facing noise pollution and give a proper solution.	2

Text Books:

1	K. Wark, C.F. Warner and W.T. Davis Air Pollution Control: its Origin and Control, Addision-Wesley, (1998).
2	Stern A.C., ―Air Pollution Vol. I and II‖, Allied Publishers Limited, 1st Edition, 1994.
3	Noise Pollution and Control Strategy by S.P. Singhal, Narosa Publishing House, 2005

Reference Books:

1	Nevers N., "Air Pollution control Engineering" McGraw-Hill, New York, 2nd edition, 1995
2	Fundamentals of Air Pollution by Richard W. Boubel, D. L. Fox, D. B. Turner and A. C. Stern, Reed Elsevier India Pvt. Ltd., New Delhi
3	Noise Pollution – S. K. Agrawal- APH Publishing corporation, New Delhi. 2009

Codes:

1	IS 4954: 1968
2	IS 5182: 1999

Course Plan

Course Title : Advance Highway Engineering Lab	
Course Code : 201CEL421	**Semester: VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks : N.A.**

Course Description:

Advance Highway Engineering lab involves techniques & methods used for transportation system.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To study the Pavement Management System, TSM, Crash reconstruction.
2. To study the various applications of GIS in Transportation engineering.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C421.1	Describe various modes of the pavement management systems & road safety audit.
C421.2	Explain the use of GIS applications in transportation engineering.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs)and
Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C421.1	3	1	-	-	-	2	-	-	-	-	-	2	1	-	3
C421.2	3	-	-	-	-	1	-	-	-	-	-	2	1	-	3

List of Assignments/Experiments/Activity

Ex. No.	Title of Assignments/Experiments/Activity based on,	Hours
1	Pavement Management System- Introduction	2
2	Network and Project Level Analysis	2
3	Systems approach to Transportation Planning-TSM Philosophy	2
4	TSM actions to Indian Urban Context	2
5	Transit and Non-Auto modes of transportation: Introduction	2
6	Measures to Promote: Transit and Non-Auto modes of transportation	2
7	Advanced Transit Technologies: Conventional and Unconventional Systems	2
8	Advanced Transit Technologies: New Technologies: LRT, Automated Highways, Hovercraft	2
9	Application of GIS in Transportation Engineering: Intelligent information system for road accessibility study	2
10	Application of GIS in Transportation Engineering	2
11	Crash Reconstruction	2
12	Crash Reconstruction: Case Studies	2
13	Activity 1	2
14	Activity 2	2
15	Activity 3	2

Reference Books:

1	Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
2	Ogden, K.W. Safer Roads: A Guide to Road Safety Engineering. Avebury Technical, 1996
3	Ralph Hass, Ronald Hudson and Zanieswki, "Modern Pavement management"- Krieger Publications.
4	W. Ronald Hudson, Ralph Haas and Waheed Uddin, 'Infrastructure Management'- Mc Graw Hill
5	Haas and Hudson , W. R. Pavement management systems –McGraw Hill publications
6	Transportation System Management Notes, S.R.Chari, REC, Warangal
7	Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill
8	The Bicycle Planning, Mike Hudson, Open Books, UK
9	GIS for Urban & Regional Planning, Scholten & Stillwen 1990, Kulwer Academie Publisher.
10	GIS A Management, Perspenfi Stan Aronoff, WDL Publisher
11	GIS By Stonffer
12	Proceedings of International Conference on Structural Design of Asphalt Pavements.
13	Proceedings of North American Conference on Managing Pavement.
14	Towards Safe Roads in Developing country, TRL – ODA, 2004

Course Plan

Course Title : Advanced Construction Methods Lab	
Course Code : 201CEL422	**Semester : VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks : N.A.**

Course Description:

To develop the more essential technology and construction approach they are able to develop the some of skills and techniques of field construction. In Advanced Construction methods, the students are able to learn the working and efficiency of advance construction methods and techniques.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To know the various advance techniques used in underwater, underground constructions.
2. Understand the advance methods used in the field of construction.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C422.1	Understand various advance techniques used in underwater, underground constructions.
C422.2	Summaries advance methods used in the field of construction.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C422.1	3	1	-	1	-	-	-	-	-	-	-	2	1	-	3
C422.2	3	2	-	1	-	-	-	-	-	-	1	2	-	1	2

LIST OF EXPERIMENTS /ACTIVITY

Sr. No.	Title	Hours
1	Assignment based on underwater construction	2
2	Assignment based on underground construction	2
3	Assignment based on introduction of bridge construction	2
4	Assignment based on methods used in bridge construction	2
5	Assignment based on Pre-fabricated construction	2
6	Assignment based on techniques used in Pre-engineering construction	2
7	Assignment based on Coffer dam construction	2
8	Assignment based on cessions construction	2
9	Assignment based on various types of pile	2
10	Assignment based on pile construction methods	2
11	Assignment based on advance formwork	2
12	Assignment based on earth retaining structures	2
13	Site visit to advance construction techniques used in construction site	2
14	Activity 1 (Case study)	2
15	Activity 2 (Case study)	2

Text Books:

1	G. A. Leonards, “Foundation Engineering” Mcgraw Hills Co.Ltd.
2	Vijaya Singh, “Wells and Caissons”, New Chand & Bros, Roorkee

Reference Books:

1	Wynn, “Formwork Design and Construction”
2	Peurifey RI, “Construction Planning Equipment’s and Methods”
3	Stubbs, “handbook of heavy Construction”

Course Plan

Course Title: Project Phase-I	
Course Code: 201CEP424	**Semester: VII**
Teaching Scheme: L-T-P: 0-0-4	**Credits: 2**
Evaluation Scheme: ISE Marks: 50	**ESE Marks: 50**

Course Description:

This course describes the research projects which support for their research work in different specialisations. These projects are based on areas like Social, Research, Interdisciplinary, Experimental and Entrepreneurship skill development.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To learn and experience the process of conducting a good research project.
2. To enhance the students' knowledge and skills in solving problem through structured project research.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C424.1	Relate available knowledge to formulate the engineering problem.
C424.2	Do literature survey and adopt appropriate methodology to execute work.
C424.3	Prepare a project report and deliver Project Phase I presentation.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C424.1	3	3	2	2	2	3	3	2	2	2	1	2	1	3	2
C424.2	2	3	1	2	3	1	1	3	3	1	2	2	3	2	3
C424.3	2	2	1	2	3	1	1	2	3	3	1	2	2	3	4

LIST OF ACTIVITY

Sr. No.	Title
1	Submission of project topic with names of group member
2	Finalization of topic and allotment of guide by department through Departmental Research Committee (DRC)
3	Introduction and literature review presentation
4	Methodology and future work presentation
5	Submission of synopsis duly signed by students and guide
6	Presentation of synopsis in front of DRC

- The project work will be a Design project, Research based, Interdisciplinary, Experimental and Entrepreneurship skill development on any of the topics of civil engineering interest.
- It will allot as a group project consisting of a minimum THREE and maximum FIVE number of students, depending upon the depth of project depth work.
- The term work assessment of the project will be done continuously throughout the semester by a DRC consisting of 3-4 faculty members from the department along with Project Guide. The students will present their project work to their respective guide before the committee. The complete project report is not expected at the end this semester. However, ten pages typed report based on the work done will have to be submitted by the students to the DRC. The project guides will award the marks to the individual students depending on the group average awarded by the committee.
- One Project Guide shall be allotted Maximum TWO groups for guidance.
- For work load calculation minimum load is 2 Hr./week, for one group of THREE to FIVE students. (As per AICTE Guide Lines).

Course Plan

Course Title : Internship	
Course Code : 201CEP425	**Semester: VII**
Teaching Scheme : L-T-P : 0-1-0	**Credits : 4**
Evaluation Scheme: ISE Marks: 75	**ESE Marks : 0**

Course Description: Internship is carried out in a construction company/ organization/ Civil Engineering Department of State or Central Governments with well-defined scope and objectives. Students during their vacation at the end of their VI semester, will approach a construction company/ organization/ industry/ Relevant Government Departments/ PSUs and will undergo internship. During this process, they finalize the objectives, scope, formulate methodology, collect the required data, interpret the data/ results, draw conclusions and suggest strategies under the guidance of a supervisor/ representative of the industry. They present the study in the form of an Internship report under guidance of the faculty member during their VII semester.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C425.1	Identify and define the problem and collect data by direct and indirect methods.
C425.2	Collect required literature survey and organize them and formulate the methodology
C425.5	Work on site for different projects.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs)and
Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C425.1	2	3	-	-	-	-	-	-	1	-	-	1	1	-	2
C425.2	2	3	-	-	-	-	--	-	2	-	-	1	-	1	3
C425.3	2	3	-	-	-	-	-	-	1	-	-	1	1	-	3

Based on the field training done by the students T.Y.B.Tech during the and summer vacation, as mentioned in the syllabus. The oral is to be conducted preferably in presence of expert from field and term work marks are finalised. The marks will be given based on performance in oral exam and the report.

*	The students are expected to undergo 4 to 6 week internship in the industry and work on the area as specified by the industry. The work should be assigned, monitored and evaluated by the concerned industry expert, based on the report by the students.
*	The department has to assign one faculty mentor who has to communicate with industry and monitor the internship related work, periodically.
*	The weight age of the evaluation will be as under.
	Industry Expert / Supervisor: 70%
	Department and faculty: 30%
	The evaluation should include presentations and submission of reports to the department at the beginning of the subsequent semester.
*	The internship can be availed by the students during the summer vacations after completion of Semester VI. The credits of internship will be considered in semester VII.
*	The industry expert / supervisor is expected to assign the work worth minimum of 100 to 120 hrs. for 4 to 6 weeks duration and should monitor and evaluate periodically.
*	At the completion of the internship work the student is expected to prepare a report on the work done and get certified from the industry expert.

Course Plan

Course Title: Construction Techniques	
Course Code: 201CEL426	**Semester: VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE+MSE: 20+30	**ESE Marks: 50**

Course Description:

Due to the introduction of new construction techniques and tools, engineering constructions have undergone a significant transformation. This course explores various techniques for construction utilizing these advanced techniques and offers a thorough overview of their utilization in the construction sector. In addition, it familiarizes the student with the tools needed for various civil engineering projects that they would be expected to use construction projects.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To study equipment's used in earth moving and hard rock excavation.

2 To understand asphalt, concreting and other construction equipment's

3 To study concept of equipment management.

4 To study introduction of value engineering.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C426.1	**Describe** the earth moving equipment's & excavation in hard rock.
C426. 2	**Explain** various asphalt and concreting equipment's.
C426.3	**Understand** other equipment's used in construction sector.
C426.4	**Explain** importance of equipment management on construction site.
C426.5	**Describe** value engineering and its importance in construction filed.

Prerequisite:	Building construction, Transportation engineering, Surveying

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C426.1	3	2	-	-	-	2	-	-	-	-	-	1	1	2	2
C426. 2	3	-	-	-	-	2	-	-	-	-	-	1	1	2	2
C426.3	3	-	-	-	-	2	-	-	-	-	-	1	1	2	2
C426.4	3	-	-	-	-	2	-	-	-	-	-	1	1	2	3
C426.5	3	-	-	-	-	2	-	-	-	-	-	1	1	2	2

Content	Hours
Unit 1. Earth Moving Equipment Tractors, bulldozers, scrappers, power shovel, hoes, drag line, clamshell, trenchers, compactors, Cycle time and production rates (simple numerical problems), types and performance, operating efficiencies, lifting capacities.	7
Unit 2. Excavation in Hard Rock and its Techniques Rippers, jack hammers, drills, compressors and pneumatic equipment's. Blasting explosives, detonators, fuses,	6
Unit 3. Asphalt and Concreting Equipment Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment.	8
Unit 4. Other Construction Equipment Control of Ground water in Excavations: Methods-pumping, well points bore wells, electro-osmosis, injections with cement, clays and chemical, freezing process, vibro-flotation. Conveying equipment- Forklifts, Portable Material Bins, Material Handling Conveyors	8
Unit 5. Equipment Management Equipment Management, Costing, Optimum utilization and Equipment selection, depreciation, interest on capital, Manpower, Spare parts etc., Documentation, Log-Books, History Books.	6
Unit 6. Value Engineering Value engineering concepts, advantages, applications, problem recognition, role in productivity, criteria for comparison, element of choice. Level of value engineering in the organization, size and skill of VE staff, VE activity, unique and quantitative evaluation of ideas.	7

Text Books:

1	S.C. Sharma "Construction equipment and management"
2	Mahesh Verma, "Construction equipment"

Reference Books:

1	R. L. Puerifoy,"Construction Planning equipment & methods," Mc Graw Hill Book
2	Stubb, "Handbook of Heavy Construction"
3	Jagman Singh, "Heavy Construction – Planning, Equipment, Methods"
4	Bryan, "Construction Technology: Analysis, and Choice", Wiley India
5	Roy Chudley and Roger Greeno, "Construction Technology", Prentice Hall, 2005.

Course Plan

Course Title: Advanced Concrete Design.	
Course Code: 201CEL427	**Semester: VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

This course builds upon the skills developed in Reinforced Concrete Design and extends them to advanced applications including: the design of Flat slab, the design of box culvert, and the design of chimney, Bunkers, silos. Determination of design actions and detailed design of super- and substructure components.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1	To understand the codal recommendations for methods of design.
2	To analyse and design of various reinforced concrete structures like flat slab, water tanks, Culvert.
3	To analyse and design of bunkers and silos.
4	To analyse and design of Raft Foundation.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C427.1	Explain the codal recommendations for methods of design.
C427.2	Analyse and design of various reinforced concrete structures like flat slab, water tanks, and culvert.
C427.3	Analyse and design of bunkers and silos.
C427.4	Analyse and design of Raft Foundation.

Prerequisite:	Strength of Material, Concrete and Steel structure

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C427.1	2	2	3	3	-	-	-	-	-	-	-	-	3	-	4
C427.2	2	2	3	3	-	-	-	-	-	-	-	-	3	-	4
C427.3	2	2	3	3	-	-	-	-	-	-	-	-	3	-	4
C427.4	2	2	3	3	-	-	-	-	-	-	-	-	3	-	4

Content	Hours
Unit 1. Flat Slab Introduction to Flat slabs, Classification and behaviour of Flat slabs, Direct design and equivalent frame method- Codal provisions.	7
Unit 2. Box Culvert. Introduction to Culvert, difference between bridge and culvert, pressure distribution diagram, types, design of box culvert.	7

Unit 3. Water Tanks Design of water tank - Introduction to working stress method for water tank design, Design criteria, permissible stresses, design of water tank resting on ground using IS code method – (i) circular water tanks with flexible and rigid joint between wall and floor, (ii) rectangular water tanks.	7
Unit 4. Concrete Chimneys Analysis of stresses in concrete chimneys- uncracked and cracked sections- Codal provisions- Design of chimney.	7
Unit 5. Bunkers and Silos: Introduction, Design of rectangular bunkers, circular bunkers and silos.	7
Unit 6. Analysis And Design of Grid Floors Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko's plate theory. Analysis of grid by stiffness matrix method, Detailing of steel in flat grids.	7

Text Books:

1	N. Krishnaraju, "Advanced Reinforced Concrete Design", CBS Publisher, 2013
2	P. C. Verghese , "Advanced Concrete Structure Design", Prentice Hall of India

Reference Books:

1	Nilson. A. H., "Design of Concrete Structures", Tata McGraw Hill, 2005
2	Ashok K Jain, "Reinforced Concrete – Limit State Design", Nem Chand & Bros., 2012
3	Jones L L , "Yield Line Analysis of Slabs", Thomas and Hudson
4	BC Punmia , "RCC Designs"., Laxmi Publications (P) Ltd. 10th Edition ,2006

Codes:

1	IS 456-2000
2	IS2210-1998- Criteria for design of reinforced concrete shell structures and folded plates
3	IS 4998-1998- Criteria for design of reinforced concrete chimneys
4	IS 3370- 1991- Part 1-4- Code of Practice for concrete structures for the storage of liquids

Course Plan

Course Title: Sustainable Water and Sanitation Systems	
Course Code: 201CEL 428	**Semester: VIII**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

Water is a finite and irreplaceable resource that is fundamental to human well-being. It is only renewable if well managed. Water is at the core of sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival itself. Sustainable sanitation is vital for the standard & quality of life. It is a prerequisite for reducing the global burden of disease, improving the health, welfare and productivity.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1. To develop understanding on key issues related to water, sanitation and hygiene.
2. To orient the students on the prevailing & modern sanitation practices.
3. To sensitize students on the importance of the provision of water, sanitation and hygiene services.
4. To introduce the students to the existing programs and policies of various bodies.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C428.1	Illustrate the need, demand and supply of WASH services & goals for sustainability
C428.2	Explain significance & systems for sustainable sanitation
C428.3	Explain various Government policies, programs, challenges related to water, sanitation and hygiene
C428.4	Explain systems of plumbing & correlation of health and sanitation.

Prerequisite:	Environmental Studies, Environmental Engineering

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C428.1	2	-	-	-	-	3	3	-	-	-	-	-	-	1	3
C428.2	-	1	-	-	-	-	-	-	-	-	2		-	1	4
C428.3	-	-	-	-	-	2	2	-	-	-	-	-	-	1	4
C428.4	1	1	-	-	-	2	2	-	-	-	-	-	-	1	4

Content	Hours
Unit 1. Sustainability & Sanitation Meaning, Concepts, Principles, and Components. Environmental Pollution and Health Hazards. Water, Sanitation and Hygiene (WASH): Concept, Meaning, Principles, and Practices. SDG goals pertaining to sustainable sanitation and environmental issues.	7
Unit 2. Water Sustainability Water: Use, Sources, Systems in rural and urban settings. Water conservation, Rain water harvesting, Institutional framework for monitoring quality and techniques for effective water sustainability, Indian standard for drinking water and waste water, Modern infrastructure for water treatment.	7
Unit 3. Sustainable Sanitation Urbanization trends in the world, Urban sanitation in India, Challenge of water supply and sanitation, Introduction to advanced treatments & infrastructure for wastewater treatment, Introduction to faecal sludge and septage, Low-cost wastewater systems – Septic tanks, two-pit latrines, Eco-toilet, soak pits.	7
Unit 4. Policies and Programmes for Sustainable Water and Sanitation Jawaharlal Nehru National Urban Renewal Mission (JNNURM), National Urban Sanitation Policy (NUSP), Swachh Bharat Mission (Urban), National Policy on Faecal Sludge & Septage Management (FSSM), Jal Jeevan Mission-Urban (JJM-U) Mission, The Atal Mission for Rejuvenation and Urban Transformation (AMRUT).	7
Unit 5. Plumbing and House drainage for sustainable sanitation: Principles of Plumbing, Requirements of plumbing fixtures, materials for plumbing fixtures, Common terms in plumbing, Layout and systems of plumbing, piping installation, testing of plumbing system. Sanitation facilities for areas without drainage system, Decentralized wastewater treatment DEWATS.	7
Unit 6. Public Health, Hygiene and Sanitation: Health and hygiene: classification of water- and excreta-related disease; relationship between water, sanitation and related disease; hygiene evaluation and promotion, Public health activities of WHO, Government & local bodies, Building byelaws for sanitation of public places.	7

Text Books:

1	G.S. Birdie and J.S. Birdie, Water Supply and Sanitary Engineering - Dhanpat Rai Publisher
2	John Pickford, "Sustainability of Water and Sanitation Systems" by Practical Action Publishing
3	Mridul Deka, Water Sustainability, Notion Press; 1st edition
4	Metcalf and Eddy Inc, Wastewater Engineering - Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
5	K. Park,Textbook of preventive & social medicine, by Banarsidas Bhanot Publishers
6	D K Thakur, Environmental Sanitation, by Discovery

Reference Books:

1	Water Lex and UN Environment, E-book Sustainable Sanitation Systems
2	Water, Engineering, and Development Centre "Sustainability of Water and Sanitation Systems", Intermediate Technology Publications, 1996
3	Joseph A. Salvato, Environmental Engineering and Sanitation, A Wiley-Interscience Series

Course Plan

Course Title: Ground Water Hydrology	
Course Code: 201CEL429	**Semester: VIII**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:
This course on 'Ground Water Hydrology' provides student with the important aspects of ground water availability/ flow/ storage/ intermixing/ investigation, while simultaneously bringing out the advanced/ relevant theories/ practices/ techniques of practical importance. The topics to be covered include, occurrence and movement of ground water, well hydraulics, pollution and quality analysis of ground water, surface/ sub-surface investigation of ground water, artificial ground water recharge techniques, saline water intrusion in aquifers, modelling and management of ground water.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1. To study the basic principles and movement of ground water and properties of ground water flow.
2. To study and analyze the various causes / processes of pollution of ground water.
3. To study the various techniques of investigations of Ground Water.
4. To study the different techniques of modelling and managing the ground water resources.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C429.1	Identify geological formations capable of storing and transporting groundwater, and determine the main aquifer properties - Permeability, transmissivity and storage.
C429.2	Identify the causes responsible for pollution of ground water sources and suggest suitable measures to reduce the pollution.
C429.3	Investigate the ground water resources by applying advanced scientific techniques.
C429.4	Perform modelling of ground water conditions and suggest measures for proper management of available ground water resources.

Pre-requisite:	Mathematics, Fluid Mechanics, Engg. Hydrology

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C429.1	3	3	-	-	-	-	-	-	-	-	-	-	1	-	2
C429.2	2	1	3	3	-	-	2	-	1	-	-	-	2	1	3
C429.3	3	3	2	1	3	-	-	-	-	-	-	-	1	1	4
C429.4	3	1	1	3	3	-	1	-	-	-	-	-	2	-	5

Content	Hours
Unit 1. Introduction: Ground water utilization & historical background, ground water in hydrologic cycle, ground water level fluctuations & environmental influence, literature/ data/ internet resources. **Occurrence and movement of ground water**: Origin and age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration and saturation, aquifers and their characteristics/classification, groundwater basins and springs.	07
Unit 2. Well Hydraulics: Darcy's Law, permeability & its determination, Dupuit's assumptions, heterogeneity &anisotropy, Ground water flow rates & flow directions, general flow equations through porous media. steady/ unsteady, uniform/ radial flow to a well in a confined and unconfined aquifer, well flow near aquifer boundaries for special conditions, partially penetrating/horizontal wells & multiple well systems.	08
Unit 3. Pollution and Quality Analysis of Ground Water: Municipal /industrial /agricultural /miscellaneous sources & causes of pollution, attenuation/ underground distribution / potential evaluation of pollution, physical /chemical /biological analysis of ground water quality, criteria & measures of ground water quality, ground water salinity & samples, graphical representations of ground water quality.	07
Unit 4. Surface/ Sub-surface Investigation of Ground Water: Geological /geophysical exploration/ remote sensing / electric resistivity /seismic refraction-based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation through geophysical / resistivity /spontaneous potential /radiation / temperature / caliper / fluid conductivity / fluid velocity /miscellaneous logging.	08
Unit 5. Artificial Ground Water Recharge: Concept & methods of artificial ground water recharge,recharge mounds & induced recharge, wastewater recharge for reuse, water spreading. **Saline Water Intrusion in Aquifers**: Ghyben-Herzberg relation between fresh & saline waters, shape & structure of the fresh & saline water interface, upcoming of saline water, fresh-saline water relations on oceanic islands, seawater intrusion in Karst terrains, saline water intrusion control.	08

Unit 6. Modeling and Management of Ground Water: Ground water modelling through porous media /analog / electric analog / digital computer models, ground water basin management concept, hydrologic equilibrium equation, ground water basin investigations, data collection & field work, dynamic equilibrium in natural aquifers, management potential & safe yield of aquifers, stream-aquifer interaction.	07

Text Books:

1	K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
2	Bower. H., "Ground Water Hydrology", McGraw Hill, New Delhi
3	H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi
4	Ground Water Assessment, Development and Management by K R Karanth, McGraw Hill Publications.

Reference Books:

1	Applied Hydrogeology by C.W. Fetta, CBS Publishers & Distributors.
2	Ground water by Bawvwr, John Wiley & Sons.
3	Ground Water by Freeze P.A., Cherry J., 1979, Prentice-Hall
4	Groundwater System Planning & Management, R. Willes & W.W.G. Yeh, Prentice Hall.

Course Plan

Course Title: Total Quality Management and Management Information System	
Course Code: 201CEL430	**Semester : VII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The purpose of this course is to learn the basic terms related to quality, concepts of quality management and role of management information system in civil engineering projects.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To study TQM, MIS; TQM principles-Systems and Quality systems organizing and implementation
2. To study TQM and MIS data collection techniques.
3. To understand TQM and MIS Applications in Civil Engineering projects
4. To know the software approach factors in TQM and MIS system

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C430.1	Study fundamentals of engineering economics
C430.2	Apply knowledge of project management in context with cost and quality.
C430.3	Illustrate the knowledge of software for management of project and data.

C430.4	Describe principles of TQM and MIS system to solve civil engineering problems.

Prerequisite:	Management for Civil Engineering

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C414.1	2	-	-	-	-	-	-	1	-	-	2	3	1	1	1
C414.2	3	-	-	-	-	-	-	1	-	-	2	3	2	2	3
C414.3	3	-	-	-	1	-	-	1	-	-	2	3	-	2	3
C414.4	3	-	-	-	-	-	-	2	-	-	2	3	2	2	4

Content	Hours
Unit 1. Introduction to TQM – Definitions – TOM framework, benefits, awareness and obstacles. Quality – vision, mission and policy statements. Importance of TQM in Civil Engineering- Significance of quality in civil engineering projects, cost implications of poor quality, role of TQM in achieving customer satisfaction.	**7**
Unit 2. Principles and Philosophies of Quality Management – Overview of the contributions of Deming, Juran Crosby, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology.	**7**

Unit 3. Quality Systems Organizing and Implementation – Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits. TQM culture. Quality circle, work study, method study, Six sigma technique	**7**
Unit 4. Introduction to MIS – Definition Role, Impact, Evolution, Structure of MIS in organization, Decision Making - Programmed and Non programmed decisions, Stages in decision making, Concepts of Information, Systems Theory, Decision Support System	**7**
Unit 5. Computers in MIS and Data Management - Hard ware, Software, Communication networks Office automation, Collection and analysis of data, Database Management system,	**7**
Unit 6. Applications of MIS – Materials, Finance, HRD, Marketing and Service sector, Socio-technical approach, Factors of success and failure, Quality assurance of MIS	**7**

Text Books:

1	Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2	Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5thEdition), SouthWestern (Thomson Learning), 2002 (ISBN 0-324-06680-5).
3	Jawadekar W. S, "Management Information System" Tata McGraw Hill

Reference Books:

1	S. Sadagopan, "Management Information System" PHI Learning Private Limited, Delhi.
2	Robert G. Murdick. Joel E Ross, Janes R. Claggeett, "Information System For Modern Management" Prentice Hall Of India.
3	Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991

Course Plan

Course Title: Design of Bridges	
Course Code: 201CEL433	**Semester : VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

This course covers fundamental concepts and methods in bridge design starting with the very basics, like definition of the bridge, different types, bridge components, etc. This course includes design examples on bridge deck, abutment and pier which will help to give the hand for the students to build their way to be bridge designer.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 To understand the types of bridges and its suitability
2 To understand the design concept of bridges i.e. superstructure and substructure

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C433.1	Classify the types of bridges and its components
C433.2	Assess the different kinds of loading on the bridge
C433.3	Design of components for different types bridges
C433.4	Analyze the substructures of the bridges

Prerequisite:	Design of concrete structures, Transportation Engineeering

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
C433.1	3	-	-	-	-	-	-	-	-	-	-	1	1	-	1
C433.2	2	-	-	-	-	-	-	2	-	-	-	-	1	-	1
C433.3	2	2	3	-	-	-	-	1	-	-	-	-	1	-	2
C433.4	2	2	3	-	-	-	-	1	-	-	-	-	1	-	2

Content	**Hours**
Unit 1. Introduction & Brief History of bridges, Classification, Importance of bridges, Components of bridges: Substructure -superstructure, Investigation for Bridges	06
Unit 2. Standard specification for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc.	6
Unit 3. General design considerations. For R.C.C. & P.S.C. bridges. Traffic aspects for highway bridges. Aesthetics of bridge design, Relative costs of bridge components. Pigeaud's theory, beam and slab and T – beam, Courbon's theory.	8

Unit 4. Construction Techniques – Construction of sub structure footing, piles, caissons, construction of reinforced earth retaining wall and reinforced earth abutments, super structure – erection methods for bridge deck construction, Repair, Strengthening, and Rehabilitation of Existing Bridges.	8
Unit 5. Design of sub structure – Abutments, Piers, Approach slab. (Numerical on Abutments, Pier)	8
Unit 6. Different types of bridge Bearing and expansion joints, forces on bearings, Types of bearings, design of unreinforced elastomeric bearings, expansion joints. (Numerical on Bearings)	6

Text Books:

1	T. R Jagadeesh and M. A. Jayaram, "Design of Bridge Structures", PHI Publications
2	S.P. Bindra, "Principles and practice of Bridge Engineering", Dhanapat Rai Publications
3	Rangwala, "Bridge Engineering", Charotar Publications.

Reference Books:

1	Dr. V. K. Raina, "Concrete Bridge Practice, Analysis, Design and Economics", Tata Publication McGraw- Hills Publishing Company Limited.
2	Dr. B. C. Punmia, "Ashok Kumar Jain, Arun Kumar Jain, "Reinforced Concrete Structures" – Vol. II by, Laxmi Publications
3	S. Ponnuswamy, "Bridge Engineering", Tata McGraw-Hills Publishing Company Limited
4	N. Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
5	IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83.

Course Plan

Course Title: Industrial Waste Management	
Course Code: 201CEL434	**Semester: VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

Economic growth is attributed to industrial development. However it is cursed by all types of pollutions. Various industries produce different types of wastes, which hamper the environmental quality. Hence, the management of Industrial waste is the need of time. This course includes the different management techniques with respect to various types of industrial wastes. It also deals with legislative aspects of industries waste management and case studies of typical industries.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To study the importance, classification and characteristics of industries waste management
2. To study the different industries waste management techniques.
3. To understand the different legislative provisions w.r.t. industries waste management.
4. To study the different industrial wastes based on types of industries.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C434.1	Illustrate the significance of industries waste management.
C434.2	Classify different parameters of industries waste
C434.3	Explain various industries waste management techniques.
C434.4	Explain legislative provisions for industries waste management.

Prerequisite:	Environmental Studies, Environmental Engineering, Air Pollution and Noise Pollution, Advance Water and wastewater treatments.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C434.1	3	3	-	-	-	1	3	-	-	-	-	-	1	1	3
C434.2	3	3	-	-	-	1	3	-	-	-	-	-	1	1	4
C434.3	3	3	-	-	-	1	3	-	-	-	-	-	1	1	4
C434.4	3	3	-	-	-	1	3	-	-	-	-	-	1	1	4

Content	Hours
Unit 1. Importance of Industrial Waste Management Introduction, history- World and Indian context, current scenario, consequences of poor industrial waste disposal, need and importance of industrial waste Management.	5
Unit 2. Classification and Characteristics of Industrial Waste Classification based on state of matter- Solid, liquid and gaseous. Classification based on characteristics- Biodegradable, Non-biodegradable, Hazardous waste, Chemical waste. Parameters and Characteristics- (Physical, chemical and biological) of solid, liquid and gaseous waste	7
Unit 3 Industrial Waste Management Techniques 5R technique: Treatment for Industrial solid waste- Composting, Vermi compost, etc. Treatment for Industrial liquid waste: Sedimentation, filtration, etc., Concept of Zero liquid Discharge Treatment for Industrial gaseous waste- absorption, adsorption, dust collection, etc. Disposal methods for Industrial waste: Landfill, Land disposal, water body disposal, ocean disposal, Underground disposal, Atmospheric disposal	7
Unit 4. Waste to Energy Options for Industrial Waste Incineration, Biomethanation, Pyrolysis, gasification, Pelletization, etc. Government policies and programs for Waste to energy Concept of Sustainable Development Goals and Industry	7
Unit 5. Waste Management legislation in India Environmental Protection Act Air Act, Water Act, Hazardous Waste Management Roll of MPCB and CPCB, Importance of ISO 14000 Importance of EIA, Environmental Management System (EMS)- Environmental Audit, Environmental clearance	7

Unit 6. Case Studies Construction industry-Ex. Cement industry, Construction demolition waste Chemical industry-Ex. Agrochemicals, Pharmaceutical, Plastic, Petrochemicals Agro based industry-Ex. Sugar, Dairy, Distillery, Textile, Paper Mechanical industry-Ex. Steel, Foundry. Electroplating, Power plant-Ex. Thermal power plant, Nuclear power plant	7

Text Books:

1	Wastewater Engineering treatment and reuse – Metcalf & Eddy, Inc., George Tchobanoglous, Franklin Burton, H. David Stensel, Tata McGraw-Hill Education, 2002
2	K. Wark, C.F. Warner and W.T. Davis Air Pollution Control: its Origin and Control, Addision-Wesley, (1998).
3	Bhide A.D. and Sundersen B.B. , "Solid Waste Management in Developing Countries", Indian National Scientific Documentation Centre, New Delhi

Reference Books:

1	Ronald Droste, John Wiley, Theory and Practice of Water and Wastewater Treatment, 2019
2	Nevers N., "Air Pollution control Engineering" McGraw-Hill, New York, 2nd edition, 1995
3	"Manual on Sewerage &Sewage Treatment" Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97,Ministry of Urban development
4	"Manual on Municipal Solid Waste Management" - Ministry of Urban Development Govt. of India.

Course Plan

Course Title: River Engineering and Hydropower	
Course Code: 201CEL435	**Semester: VIII**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:
The course includes river engineering, its classification and behaviour, meandering phenomenon of river. Information related to river training and protection works . Also the course includes hydal projects in India and their importance, information related to conveyance system, power house, component of hydal projects and types of hydal projects and modern types of turbines**.**

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To study fundamentals of rivers, river morphology and classification scheme.
2 To study behavior of the rivers, meander phenomenon and mechanics of alluvial river.
3 To understand river protection works.
4 To study fundamentals of sources of energy, estimation of hydro power available, types of hydro power plants and water conveyance systems
5 To study types and classification of different components of hydro power plants and general arrangements of power stations
6 To know basic components functions and types of turbine, choice of turbine, turbine setting and cavitations

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
CEL435.1	Student will able to classify types and classification of rivers and illustrate river channel pattern
CEL435.2	Understand concept of mechanics of alluvial river and socio-cultural influences.
CEL435.3	Identify water power potential and components of water power plant and classify different components of hydro power plants
CEL435.4	Understand concept of hydropower projects, tidal power plants with their general description

Prerequisite:	Hydraulics, Hydraulic machines, Water Resources Engineering

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C435.1	1	2	2	-	-	-	-	-	-	-	-	1	-	-	2
C435.2	1	2	2	-	-	-	-	-	-	-	-	1	1	-	2
C435.3	2	2	2	-	-	-	-	-	-	-	-	1	-	1	2
C435.4	2	3	3	-	-	-	-	-	-	-	-	1	-	-	2

Content	Hours
Unit 1. Introduction to Rivers Introduction, Classification of Rivers, Mechanics of alluvial rivers including channel and flood pain features, sediment transport and budget , river morphology and various classification scheme	6
Unit 2. River Behaviour Behaviour of rivers, Introduction, River channel patterns, straight river channel, causes, characteristic and shapes of menders and control, cutoff, braided rivers, bed forms, instability of rivers, hydraulic geometry, delta formation and control	7
Unit 3. River Mechanics Mechanics of alluvial river, rivers and restoration structures, socio – cultural influences and ethics of stream restoration	6
Unit 4. Water Power Engineering Water Power: Introduction to Sources of Energy, Role of Hydropower in overall power generation, Estimation of water power potential. Electrical Load on Hydro Turbines: Load Curve, load Factor, Capacity Factor, Utilization factor, Diversity Factor, Load Duration Curve, Firm Power, Secondary Power, Prediction of load.	7
Unit 5. Introduction to Hydro Power Plant Types of hydro power plant: Classification of hydropower plants, General arrangements of Run of River Plants, Valley Dam Plants, Diversion Canal plants, High Head diversion plants, Pumped storage power plants, Tidal Plants.	7
Unit 6. Design Principles of Conveyance System Preliminary design principals of conveyance system: Power canals, Penstock. Case study of a micro, mini and Major hydropower project in India	7

Text Books:

1	K D Gupta – 'River Engineering' - Vayu Education of India
2	Dandekar M. M. & Sharma K. N.; 'Water Power Engineering': Vikas Publishing House Pvt.Ltd.,New Delhi, 2003
3	Sharma R K & Sharma T K, Text book of 'Water Power Engineering', S chand publication, 2003

Reference Books:

1	P Ph.Jansen, 'Principles of River Engineering' -VSSO
2	B C Punmia, 'Irrigation and Water Power Engineering'- LP
3	Santosh Kumar, 'River Engineering' – Khanna Book Publisher
4	E Mosoni, 'Water Power Development' –Vol. I &II
5	Streeter V. L. & Wylie E. B. 'Hydraulic Transient', McGraw Hill Book Company, New York.20
6	Chaudhary Hanif, 'Applied Hydraulic Transients', Van Nostrand Rein Hold Company, New York 1992
7	'Design of small dams', USBR Publications

Course Plan

Course Title: Construction Techniques Lab	
Course Code: 201CEL439	**Semester: VIII**
Teaching Scheme: L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme: ISE Marks: 25	**ESE Marks : N.A.**

Course Description:

Due to the introduction of new construction techniques and tools, engineering constructions have undergone a significant transformation. This course explores various techniques for construction and offers a thorough overview of their utilization in the construction sector. In addition, it familiarizes the student with the tools needed for various civil engineering projects that they would be expected to use in construction projects.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To study equipment used in earth moving and hard rock excavation.

2 To understand asphalt, concreting and other construction equipment.

3 To study concept of equipment management and value engineering.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C439.1	**Describe** the earth moving equipment & excavation in hard rock.
C439. 2	**Explain** various asphalt and concreting equipment.
C439.3	**Explain** importance of equipment management on construction site and value engineering..

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs)and
Program Specific Outcomes (PSOs)

POs/ Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C439.1	3	2	-	-	-	2	-	-	-	-	-	1	1	2	2
C439. 2	3	-	-	-	-	2	-	-	-	-	-	1	1	2	2
C439.3	3	-	-	-	-	2	-	-	-	-	-	1	1	2	3

LIST OF EXPERIMENTS/ACTIVITY

Experiment No	List of Experiments	Hours
1	Working and suitability of Tractors, bulldozers, scrappers, power shovel, hoes, drag line.	2
2	Evaluate cycle time and production rates (simple numerical problems),	2
3	Its types and performance, operating efficiencies, lifting capacities.	2
4	Working and suitability of Rippers, jack hammers, drills,	2
5	Working and suitability of compressors and pneumatic equipment.	2
6	Suitability of Blasting explosives, detonators, fuses	2
7	Working and suitability of asphalt equipment.	2
8	Working and suitability of concreting equipment.	2
9	Concept of control of ground water.	2
10	Working and suitability of conveying equipment.	2
11	Study of costing, Optimum utilization and Equipment selection.	2
12	Concept of Documentation, Log-Books, and History Books.	2
13	Introduction of value engineering.	2
14	Concept of value engineering applications in construction.	2
15	Site visit to study various equipments used on construction projects.	2

Text Books:

1	S.C. Sharma "Construction equipment and management"
2	Mahesh Verma, "Construction equipment"

Reference Books:

1	R. L. Puerifoy,"Construction Planning equipment & methods," Mc Graw Hill Book
2	Stubb, "Handbook of Heavy Construction"
3	Jagman Singh, "Heavy Construction – Planning, Equipment, Methods"
4	Bryan, "Construction Technology: Analysis, and Choice", Wiley India
5	Roy Chudley and Roger Greeno, "Construction Technology", Prentice Hall, 2005.

Course Plan

Course Title: Project Phase-II	
Course Code: 201CEP440	**Semester: VIII**
Teaching Scheme: L-T-P: 0-0-6	**Credits: 3**
Evaluation Scheme: ISE Marks: 75	**ESE Marks: 100**

Course Description:

This course describes the research projects which support for their research work in different specialisations. These projects are based on areas like Social, Research, Interdisciplinary, Experimental and Entrepreneurship skill development.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To learn and experience the process of conducting a good research project.
2. To enhance the students' knowledge and skills in solving problem through structured project research.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C440.1	Demonstrate knowledge of research-based skills through analysis and interpretation.
C440.2	Execute a project and complete all task satisfactorily within time and budget.
C440.3	Prepare final project report and deliver project phase II presentation.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C440.1	3	3	3	3	3	2	1	2	3	2	1	2	3	2	3,4
C440.2	3	2	1	1	3	2	1	3	3	2	3	3	3	3	4
C440.3	3	3	1	2	3	2	1	2	3	3	1	2	2	2	4

LIST OF ACTIVITY

Sr. No.	Title
1	Progress presentation I.
2	Progress presentation II.
3	Final presentations in front of DRC along with submission of spiral bound copy.
4	Checking of project format on spiral bound by DRC.
5	Submission of final bound copy along with published paper.

- The project work started in the seventh semester will continue in this semester. The students will complete the project work in this semester and present it before the assessing committee. The term work assessment committee as constituted in the seventh semester will assess the various projects for the relative grading and group average. The guides will award the marks for the individual students depending on the group average.
- Each group will submit the copies of the completed project report signed by the guide to the department. The head of the department will certify the copies and return them to the students. One copy will be kept in the departmental library.
- For work load calculation minimum load is 2 Hr./week, for one group of THREE to FIVE students. (As per AICTE Guide Lines)

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C440.1	3	3	3	3	3	2	1	2	3	2	1	2	3	2	3,4
C440.2	3	2	1	1	3	2	1	3	3	2	3	3	3	3	4
C440.3	3	3	1	2	3	2	1	2	3	3	1	2	2	2	4

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HoD Civil