Scheme & Syllabus

for

B.Tech.

(Civil Engineering)

(2nd Year to 4th Year)

(w.e.f. 2021-2022)

Department of Civil Engineering

Guru Jambheshwar University of Science and Technology, Hisar-125001

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Vision

To develop competent and capable Civil Engineering students with an emphasis on the value-based state of the art technical knowledge, innovation and entrepreneurial skills for the development of the society.

Mission

To generate trained manpower with great scientific orientation.
To impart technical knowledge, soft skills, leadership qualities and professional ethics among the students.
To benefit humanity, nation and society through research, creativity, problem solving and application development.
To expose students to the recent trends and technologies with industry collaboration about environmental and stocietal concerns.
To occupy a position of pride among the eminent educational institutes of the Country.

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Program Educational Objectives (PEOs)

PEO1	**To develop a professional to pursue career as a Civil Engineer with adequate technical knowledge and skills while using modern tools for problem solving and exhibiting qualities of communication, team membership, and leadership.**
PEO2	**To develop ability to practice ethically focusing on social relevance, environmental sustainability, optimal solutions and safety of stakeholders.**
PEO3	**To develop abilities of lifelong learning to continuously strive to enhance decision making abilities to investigate, design and develop complex facilities.**

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Program Outcomes (POs)

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

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Program Specific Outcomes (PSOs)

PSO1	**Able to analyze various Civil Engineering Structures and Systems by using basic and advanced technologies.**
PSO2	**Able to design Civil Engineering facilities and their elements and also use of modern software tools for the same.**
PSO3	**Able to plan, monitor and supervise construction activities to complete Civil Engineering facilities satisfactorily.**

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Template for Course Outcomes with Revised Blooms Taxonomy (RBT's)

Sr. No.	Course Outcomes	RBT Level
CO1	Students will be able to ……	(LOTS) Remembering
CO2	Students will be able to ……	(LOTS) Understanding
CO3	Students will be able to ……	(LOTS) Applying
CO4	Students will be able to ……	(HOTS) Analyzing
CO5	Students will be able to ……	(HOTS) Evaluating
CO6	Students will be able to ……	(HOTS) Creating

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Structure of B.Tech. (Civil Engineering) Programme

Credit Score

(I) Semester Wise

Sr. No.	Semester	Credit
1	Third	19
2	Forth	20.5
3	Fifth	19
4	Sixth	22.5
5	Seventh	23
6	Eight	18
Total		**122**

(II) Humanities and Social Sciences including Management Courses

Sr. No.	Semester	Course Title	Credit
1	3rd	Introduction to Civil Engineering (Theory)	3
3	5th	Economics for Engineers (Theory)	2
4	6th	Fundamentals of Management for Engineers (Theory)	2
Total			**7**

(III) Open Elective Course(s) offered to other Departments

Sr. No.	Semester	Course Title	Credit
1	5th	Introduction to Civil Engineering	3
2	6th	Introduction to Road Safety Audit	3
3	7th	Air & Noise Pollution Control	3

(IV) Professional Elective Courses

Professional Elective Course-I				
Sr. No.	**Semester**	**Course Title**	**Code**	**Credit**
1	6th	Air & Noise Pollution Control (Theory)	PEC-CVE350-T	3
2		Solid and Hazardous Waste Management (Theory)	PEC-CVE351-T	
3		Environmental Impact Assessment and Life Cycle Analyses (Theory)	PEC-CVE352-T	
4		Water and Air Quality Modelling (Theory)	PEC-CVE353-T	
5		Disaster Preparedness & Planning (Theory)	PEC-CVE354-T	
Any one MOOC Course-Not Studied (to be studied) till now of 3 credits				
Professional Elective Course -II				
Sr. No.	**Semester**	**Course Title**	**Code**	**Credit**
1	7th	Pavement Design (Theory)	PEC-CVE450-T	3
2		Geometric Design of Highways (Theory)	PEC-CVE451-T	
3		Traffic Engineering & Management (Theory)	PEC-CVE452-T	
4		Introduction to Road Safety Audit	PEC-CVE463-T	
5		Airport Planning and Design of Airfield Pavements	PEC-CVE464-T	
Any one MOOC Course-Not Studied (to be studied) till now of 3 credits				
Professional Elective Course -III				
Sr. No.	**Semester**	**Course Title**	**Code**	**Credit**
1	7th	Construction Management (Theory)	PEC-CVE453-T	3
2		Advanced Construction Materials (Theory)	PEC-CVE454-T	
3		Advanced Construction Techniques (Theory)	PEC-CVE455-T	
Any one MOOC Course-Not Studied (to be studied) till now of 3 credits				
Professional Elective Course-IV				
Sr. No.	**Semester**	**Course Title**	**Code**	**Credit**
1	8th	Foundation Engineering (Theory)	PEC-CVE456-T	3
2		Ground Improvement (Theory)	PEC-CVE457-T	
3		Geotechnical Design (Theory)	PEC-CVE458-T	
Any one MOOC Course-Not Studied (to be studied) till now of 3 credits				
Professional Elective Course -V				
Sr. No.	**Semester**	**Course Title**	**Code**	**Credit**
1	8th	Irrigation & Design of Hydraulic Structures (Theory)	PEC-CVE460-T	3
2		Open Channel Flow (Theory)	PEC-CVE461-T	
3		Groundwater Engineering (Theory)	PEC-CVE462-T	
Any one MOOC Course-Not Studied (to be studied) till now of 3 credits				
Total			**15**	

Scheme

&

Syllabus

DEPARTMENT OF CIVIL ENGINEERING

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

SEMESTER-3								
Category	**Course Code**	**Course Name**	**Teaching Schedule**			**Hours/ Week**	**Credits**	**Duration of Exam (Hrs)**
			L	**T**	**P**			
HSMC	HSMC-CVE201-T	Introduction to Civil Engineering	3	0	0	3	3	3
PCC	PCC-CVE201-T	Surveying–I	3	0	0	3	3	3
PCC	PCC-CVE203-T	Building Construction	3	0	0	3	3	3
PCC	PCC-CVE207-T	Strength of Material	3	0	0	3	3	3
PCC	PCC-CVE209-T	Fluid Mechanics	3	0	0	3	3	3
PCC	PCC-CVE201-P	Surveying–I Lab	0	0	2	2	1	3
PCC	PCC-CVE203-P	Building Construction Lab	0	0	2	2	1	3
PCC	PCC-CVE207-P	Strength of Material Lab	0	0	2	2	1	3
PCC	PCC-CVE209-P	Fluid Mechanics Lab	0	0	2	2	1	3
MC	MC 102-T	Environmental Science	3	0	0	3	0	3
TOTAL			**19**					
MC: Mandatory Course, which will be a non-credit subject and the student has to get pass marks in order to qualify for the award of degree								

SEMESTER-4								
Category	**Course Code**	**Course Name**	**Teaching Schedule**			**Hours/ Week**	**Credits**	**Duration of Exam (Hrs)**
			L	**T**	**P**			
PCC	PCC-CVE202-T	Design of Concrete Structures-I	3	0	0	3	3	3
PCC	PCC-CVE204-T	Structural Analysis –I	3	1	0	4	3.5	3
PCC	PCC-CVE206-T	Advanced Fluid Mechanics	3	0	0	3	3	3
PCC	PCC-CVE208-T	Environmental Engineering	3	0	0	3	3	3
PCC	PCC-CVE210-T	Concrete Technology	3	0	0	3	3	3
PCC	PCC-CVE202-P	Design of Concrete Structures-I Lab	0	0	2	2	1	3
PCC	PCC-CVE204-P	Structural Analysis –I Lab	0	0	2	2	1	3
PCC	PCC-CVE206-P	Advanced Fluid Mechanics Lab	0	0	2	2	1	3
PCC	PCC-CVE208-P	Environmental Engineering Lab	0	0	2	2	1	3
PCC	PCC-CVE210-P	Concrete Technology Lab	0	0	2	2	1	3
TOTAL			**20.5**					
NOTE: The students will have to undergo survey camp of 4-6 weeks duration during summer vacations which will be evaluated in 5th sem. **The students will also have to visit at least one construction site during the entire semester.**								

SEMESTER-5								
Category	**Course Code**	**Course Name**	**Teaching Schedule**			**Hours/ Week**	**Credits**	**Duration of Exam (Hrs)**
			L	**T**	**P**			
HSMC	HSMC-301-T	Economics for Engineers	2	0	0	2	2	3
PCC	PCC-CVE301-T	Irrigation and Water Resource Engineering	2	0	0	2	2	3
PCC	PCC-CVE303-T	Structural Analysis-II	3	1	0	4	3.5	3
PCC	PCC-CVE305-T	Surveying –II	3	0	0	3	3	3
PCC	PCC-CVE307-T	Design of Concrete Structure-II	3	1	0	4	3.5	3
PCC	PCC-CVE303-P	Structural Analysis-II Lab	0	0	2	2	1	3
PCC	PCC-CVE305-P	Surveying –II Lab	0	0	2	2	1	3
INT	INT-CVE-301-P	Survey Camp	0	0	2	2	0	3
PCC	PCC-CVE309-P	Software Lab-I	0	0	2	2	0	3
MC	MC 104-T	Essence of Indian Traditional Knowledge	3	0	0	3	0	3
OE	OEC-I	Open Elective -I	3	0	0	3	3	3
TOTAL			**19**					

NOTE: Assessment of survey camp will be based on presentation/seminar, viva-voce, report and field work at the end of 5th sem.

OEC-I: To be offered by other Departments.

The students will also have to visit at least one construction site during the entire semester.

SEMESTER-6								
Category	**Course Code**	**Course Name**	**Teaching Schedule**			**Hours/ Week**	**Credits**	**Duration of Exam (Hrs)**
			L	**T**	**P**			
HSMC	HSMC –302-T	Fundamentals of Management for Engineers	2	0	0	2	2	3
PCC	PCC-CVE302-T	Transportation Engineering -I	3	0	0	3	3	3
PCC	PCC-CVE304-T	Sewage Treatment	2	0	0	2	2	3
PCC	PCC-CVE306-T	Soil Mechanics	3	0	0	3	3	3
PCC	PCC-CVE308-T	Design of Steel Structure-I	3	1	0	4	3.5	3
PCC	PCC-CVE302-P	Transportation Engineering. -I Lab	0	0	2	2	1	3
PCC	PCC-CVE304-P	Sewage and Sewage Treatment Lab	0	0	2	2	1	3
PCC	PCC-CVE306-P	Soil Mechanics lab	0	0	2	2	1	3
PEC	PEC-I	Professional Elective Course-I	3	0	0	3	3	3
OE	OEC-II	Open Elective -II	3	0	0	3	3	3
TOTAL			**22.5**					

NOTE: At the end of 6th sem., each student will undergo 4 to 6 weeks Internship/Practical Training -I in an industry/Research Institute.

OEC-II: To be offered by other Departments.

The students will also have to visit at least one construction site during the entire semester.

SEMESTER-7								
Category	**Course Code**	**Course Name**	**Teaching Schedule**			**Hours/ Week**	**Credits**	**Duration of Exam (Hrs)**
			L	**T**	**P**			
PCC	PCC-CVE401-T	Green Building and their Techniques	3	0	0	3	3	3
PCC	PCC-CVE403-T	Transportation Engineering -II	3	0	0	3	3	3
PCC	PCC-CVE405-T	Design of Steel Structure-II	3	0	0	3	3	3
PEC	PEC-II	Professional Elective Course-II	3	0	0	3	3	3
PEC	PEC-III	Professional Elective Course -III	3	0	0	3	3	3
OE	OEC-III	Open Elective -III	3	0	0	3	3	3
PROJ*	PROJ-CVE401-P	PROJECT -I	0	0	8	8	4	3
INT**	INT-CVE-401-P	Industrial Training-I	0	0	2	2	1	3
PROJ	PROJ-CVE403-P	Project Writing Lab	0	0	2	2	0	3
PCC	PCC-CVE407-P	Software Lab-II	0	0	2	2	0	3
TOTAL			**23**					

NOTE: * The project should be initiated by the student in the beginning of 7th Sem. and will be evaluated at the end of the semester on the basis of a presentation delivered, viva-voce and report by external examiner.
****Assessment of Sz-I will be based on presentation/seminar, viva-voce, report and certificate for the practical training taken at the end of 6th sem.**

OEC-III: To be offered by other Departments.
The students will also have to visit at least one construction site during the entire semester.

SEMESTER-8								
Category	**Course Code**	**Course Name**	**Teaching Schedule**			**Hours/ Week**	**Credits**	**Duration of Exam (Hrs)**
			L	**T**	**P**			
PCC	PCC-CVE402-T	Construction Costing and Management	3	0	0	3	3	3
PCC	PCC-CVE404-T	Transportation Engineering-III	3	0	0	3	3	3
PEC	PEC-IV	Professional Elective Course -IV	3	0	0	3	3	3
PEC	PEC-V	Professional Elective Course -V	3	0	0	3	3	3
PROJ*	PROJ-CVE402-P	PROJECT-II	0	0	10	10	5	3
PROJ	PROJ-CVE404-P	SEMINAR	0	0	2	2	1	3
GF	GF-CVE406-P	General Fitness for Profession	0	0	0	0	0	3
TOTAL			**18**					

NOTE: * The project should be initiated by the student in continuation of the 7th sem. and will be evaluated at the end of the 8th semester on the basis of its implementation (software/hardware), presentation delivered, viva-voce and report by external examiner and chairperson

Introduction to Civil Engineering

Sem-III

General Course Information:

Course Code: HSMC-CVE201-T Course Credits: 3 Mode: Lecture (L) Type: HSMC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Introduction to what constitutes Civil Engineering	L1(Remembering)
CO2.	Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering	L2(Understanding)
CO3.	Analyzing various possibilities of a career in this field	L4(Analyzing)
CO4.	Evaluate the depth of engagement possible within each of these areas	L5(Evaluating)

Course Contents

UNIT-I

Stones -Characteristics of good building stones-common building stones and their uses, Bricks- Classification of bricks, constituents of good brick earth, harmful ingredients, manufacturing of bricks, testing of bricks. Timber-Classification of Timber and their uses-Cement-Types of cement and their uses, Components of sub structure and their functions-Components of super structure and their functions, Concrete- Ingredients of concrete and its importance in construction

UNIT-II

Modes of transportation – Classification of highways - Classification of pavements – Super elevation. Overview of Road accidents in India and various important initiatives taken by MORTH. Origin of soil – types of soil – bearing capacity of soil – Types of foundation – shallow and deep.

UNIT-III

Definition and classification of irrigation, Introduction to Solid waste management, Methods to mitigate the solid wastes, Water purification, Wastewater treatment & Recycling.

UNIT-IV

Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity, Sustainability measures; Innovations and methodologies for ensuring Sustainability. Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects.

REFERENCES

1. B C Punmia, Ashok K Jain, Arun K Jain, (1st Edition, 2003), "Basic Civil Engineering", Laxmi Publications (P) Ltd.

2. G K Hiraskar, (1st Edition, 2004), "Basic Civil Engineering", Dhanpat Rai Publication.

3. Civil Engineering-Societal and Global Impact Dr. R.P. Rethaliya

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	--	-	2	1	-	-	-	-	-	1	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	3	2	1	-	-	-	-	-	-	1	-	3	-	2
CO4	-	-	2	-		2	1	-	-	-	--	1	-	-	2

Surveying-I
Sem-III

General Course Information:

Course Code: PCC-CVE201-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Use of different instruments used for different types of surveys.	**L1(Remembering)**
CO2	Identify data collection methods and prepare field notes	**L2(Understanding)**
CO3	Demonstrate the working principles of survey instruments	**L3(Applying)**
CO4	Calculate angles, distances and levels	**L5(Evaluating)**
CO5	Interpret survey data and plot topographical maps	**L6(Creating)**

Course Contents

UNIT-I

Fundamental Principles of Surveying: Definition, objects, classification, fundamental principles, methods of fixing stations.

Measurement of distances: Direct measurement, instruments for measuring distance, instruments for making stations, chaining of line, errors in chaining, tape corrections examples.

Compass Traversing: Methods of traversing, instruments for measurement of angles-prismatic and surveyor's compass, bearing of lines, local attraction, examples.

UNIT-II

Leveling: Definition of terms used in leveling, types of levels and staff, temporary adjustment of levels, principles of leveling, reduction of levels, booking of staff readings, examples, contouring, characteristics of contours lines, locating contours, interpolation of contours.

Plane Table Surveying: Plane table, methods of plane table surveying, radiation, intersection, traversing and resection, two point and three-point problems.

UNIT-III

Theodolite and Theodolite Traversing: Theodolites, temporary adjustment of theodolite, measurement of angles, repetition and reiteration method, adjustment of closed traverse, examples.

Tachometry: Uses of tachometry, principle of tachometric surveying, instruments used in tachometry, systems of tachometric surveying-stadia system fixed hair method, determination of tachometric constants, tangential systems.

UNIT-IV

Curves: Classification of curves, elements of simple circular curve, examples of simple curves. Transition Curves-Length and types of transition curves, length of combined curve, examples. Vertical Curves: Necessity and types of vertical curves.

REFERENCE BOOKS

1. Surveying Vol.I & II by S.K. Duggal
2. Surveying Vol.I & II by B.C.Punmia
3. Surveying by C. Venkatramaiah
4. Surveying Vol.I by T.P.Kanitkar
5. Fundamentals of Surveying by S. K. Roy
6. Surveying and levelling by R. Subramaniam
7. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.
8. Chandra A. M., Plane Surveying, New Age International Publ., 2007.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	1	1	-	-	-	1	1	-	-	1	-	2
CO2	1	2	-	1	1	-	-	-	1	1	-	-	1	-	2
CO3	1	-	-	-	1	-	1	-	1	2	1	1	2	1	2
CO4	1	1	1	-	1	-	-	-	-	-	-	2	1	2	-
CO5	1	1	1	-	2	1	-	3	3	2	-	2	1	2	2

Building Construction
Sem-III

General Course Information:

Course Code: PCC-CVE203-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr. No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Describe weathering process and mass movement of rocks to soil and State the kind of material construction	L1(Remembering)
CO2	Distinguish geological formations	L2(Understanding)
CO3	Identify and Analyze different component of the building	L4(Analyzing)
CO4	Plan and draw constructional details of differing building components	L6(Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Geology: Importance of geology in Civil engineering. Earth-surface features and internal structure, weathering of rocks. Formation and classification of rocks – Igneous, Sedimentary and metamorphic rocks

UNIT-II

Masonry Construction: Introduction, various terms used, stone masonry-Dressing of stones, Classifications of stone masonry, safe permissible loads, Brick masonry-bonds in brick work, laying brick work, structural brick work-cavity and hollow walls, reinforced brick work, Defects in brick masonry, composite stone and brick masonry, glass block masonry.

Damp-Proofing and Water-Proofing: Defects and causes of dampness, prevention of dampness, materials used, damp-proofing treatment in buildings, water proofing treatment of roofs including pitched roofs.

UNIT-III

Acoustics, Sound Insulation and Fire Protection: Classification, measurement and transmission of sound, sound absorber, classification of absorbers, sound insulation of buildings, , fire-resisting properties of materials, fire resistant construction and fire protection requirements for buildings.

Paints and Varnishes: Basic constituents of paints, types of paints, painting of wood, constituents of varnishes, characteristics and types of varnishes.

UNIT-IV.

Roofs and Floors: Types of roofs, various terms used, roof trusses-king post truss, queen post truss etc. Floor structures, ground, basement and upper floors, various types of floorings.

Doors and Windows: Locations, sizes, types of doors and windows, fixtures and fasteners for doors and windows.

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REFERENCE BOOKS:

1 Building Construction, Sushil Kumar, Standard Publishers, New. Delhi

2 Building Construction by B.C.Punmia, Lakshmi Publication Pvt. Ltd, New Delhi

3 Building Material by S.C.RangawalaCharotra Broths. Stall Anand.TulsiSadan, Station Road (W. Railway)

4 Parbin Singh., "Engineering and General Geology", Katson Publishers, 2009

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO2	-	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO3	-	-	-	-	-	-	-	1	1	-	-	1	2	-	-
CO4	-	-	-	-	-	-	-	1	1	-	-	1	2	2	2

Strength of Material
Sem-III

General Course Information

Course Code PCC-CVE207-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr. No.	Course Outcomes At the end of the course, the student will be able to:	RBT Level
CO1	Knowledge of various types of stresses and strains and their analysis	L1
CO2	Understanding the forces on statically determinate beams	L2
CO3	Find out deformations of statically determinate beams	L3
CO4	Analyze of columns loaded axially and eccentrically.	L4
CO5	Design the determinate trusses, thin cylinders and spheres.	L5

UNIT – I

Introduction: Concept of Equilibrium General Equilibrium equations, concept of free body diagrams, Concept of stress and strain, generalized Hooke's law, Stress-strain diagram of ductile and brittle material, compound and composite bars, thermal stresses, Analysis of Principal stresses and Strains, Mohr's stress circle, Relationship among elastic constants.

UNIT – II

Theory of pure bending: Centroid of simple and built-up section, second moment of area, derivation of flexural formula for straight beams, bending stress calculation for beams of simple and built up section, RCC beams.

Shear Stresses in Beams: Shear stress formula for beams, shear stress distribution in beams.

UNIT – III

Torsion of Circular shafts: Basic assumptions, torsion formula, power transmitted by shafts, design of solid and Hollow shafts based on strength and stiffness.

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Euler's, Rankine, Gordon's formulae Johnson's empirical formula for axial loading columns and their applications.

UNIT - IV

Strain energy: strain energy under axial, bending, shear, torsion, gradual, sudden and impact loading, theories of failures

Analysis of determinate Trusses: Introduction, determination of forces in member of trusses by method of joints, method of sections.

Thin cylinder and Spheres: Introduction, stresses and strains in thin cylinders and spherical shell, volumetric change, wire wound thin cylinders, thin vessels subjected to internal pressure.

Text Books

1. Strength of Materials by G H Ryder, ELBS publishers
2. Elements of Strength of Materials by Timoshenko & Young, East-West Press, New Delhi
3. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill.
4. Elementary Structural Analysis, Norris & Wilbur, McGraw Hill Publisher
5. Engineering Mechanics Shames

Reference Books

1. Strength of Materials by Sadhu Singh, Khanna Publishers
2. Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill Publication.
3. Fundamentals of Solid Mechanics by M L Gambhir, Prentice Hall of India
4. Strength of Materials Ramamurtham and Narayanan, S. Chand & Co.
5. Fundamentals of Structural Analysis B D Nautiyal, New Age Publishers

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	1	1	1	1	-	-	-	-	-	-	-	1	1	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	1	1	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-	1	2	-	-
CO5	2	2	2	1	-	-	-	-	-	-	-	1	2	-	-

Fluid Mechanics

Sem-III

General Course Information:

Course Code: PCC-CVE209-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours(L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Outline principles of hydrostatics and explain the concept of buoyancy and state of equilibrium	L1
CO2	Understand the properties of fluids and their behavior under static and dynamic conditions and measure fluid pressure in a manometer	L2
CO3	Use fluid measuring devices like venture meter, orifice meter, notches and mouthpiece	L3
CO4	Distinguish various types of flows and solve the problem on continuity equation, stream function and velocity potential function	L4
CO5	Evaluate Bernoulli's equation and use it to solve the problems of fluids	L5
CO6	Formulate one-, two- and three-dimensional continuity equations in Cartesian coordinates	L6

Course Content

UNIT-I

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT-II

Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers.

pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT-III

Fluid Kinematics-Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

UNIT-IV

Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturi meter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines , Mahesh Kumar, Pearson Education, 2019
2. Fluid Mechanics and Hydraulic Machine by R. K. Bansal
3. Fluid mechanics and Fluid Power Engg. by D.S. Kumar
4. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
5. Hydraulics and Fluid Mechanics, P N Modi and S M Seth, Standard Book House
6. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
7. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	1	1	-	1	1	-	-
CO2	1	1	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	1	1	1	-	-	-	-	-	1	1	-	1	1	-	1
CO4	2	1	1	-	-	-	-	-	2	2	-	1	2	-	1
CO5	2	3	2	-	-	-	-	-	1	2	-	1	2	-	1
CO6	2	2	2	-	-	-	-	-	2	-	-	2	2	-	1

Surveying-I Lab

Sem-III

General Course Information:

Course Code: PCC-CVE201-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also condu laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it the Chairperson office along with the internal assessment marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Calculate angles, distances and levels	L1(Remembering)
CO2	Identify data collection methods and prepare field notes	L2(Understanding)
CO3	Estimate measurement errors and apply corrections	L5(Evaluating)
CO4	Interpret survey data and plot topographical maps	L6(Creating)

LIST OF EXPERIMENTS:

1 Chain surveying: Chaining and chain traversing.

2 Compass traversing.

3 Plane table Survey methods of plane table surveying, two point problem.

4 Plane table Survey methods of plane table surveying three point problem.

5 Leveling: Profile leveling

6 Levelling: longitudinal section and cross sections levelling

7. Reciprocal leveling.
8. Permanent adjustment of level.
9. Contouring and preparation contour map.

REFERENCE BOOKS

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2005.
2. . Chandra A. M., Plane Surveying, New Age International Publ., 2007.
3. Charles D Ghilani, Paul R Wolf., Elementary Surveying, Prentice Hall, 2012.
4. Surveying Vol.I & II , B.C.Punmia
5. Surveying by C. Venkatramaiah
6. Surveying Vol.I by T.P.Kanitkar
7. Fundamentals of Surveying by S. K. Roy
8. Surveying and levelling by R. Subramaniam

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	-	-	-	-	-	1	2	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	3	-	-	-	-	-	-	-	-	1	-	1	2	-
CO5	1	-	-	-	-	-	-	3	-	-	-	1	-	2	2

Building Construction Lab

Sem-III

General Course Information:

Course Code: PCC-CVE203-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

Sr. No.	**Course outcomes** At the end of the course students will be able to:	**RBT* Level**
CO1	Distinguish geological formations	L2(Understanding)
CO2	Identify and Analyze different component of the building	L4(Analyzing)
CO3	Plan and draw constructional details of differing building components	L6(Creating)

LIST OF EXPERIMENTS:

1. Distinguish between different geological formations
2. Identification of Rocks and Minerals
3. Draw Different brick masonry bonds
4. Draw Different types of trusses
5. Draw Different types of doors and windows

REFERENCE BOOKS

1. Parbin Singh., "Engineering and General Geology", Katson Publishers, 2009

2. Building Construction, Sushil Kumar, Standard Publishers, New. Delhi

3. Building Construction by B.C.Punmia, Lakshmi Publication Pvt. Ltd, New Delhi

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	1	1	-	-	1	2	-	-
CO3	-	-	-	-	-	-	-	1	1	-	-	1	2	2	2

Strength of Material Lab

Sem-III

General Course Information:

Course Code: PCC-CVE207-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Identify materials' properties	L1
CO2	Understand flexural and torsional behavior	L2
CO3	Suitability of structural steel	L3

LIST OF EXPERIMENTS:

1. To determine Rockwell hardness number of the specimen of steel/soft metal.
2. To determine Brinell hardness number of the specimen of steel/soft metal.
3. To determine Vickers hardness number of the specimen of steel/soft metal.
4. To study the behavior of ductile material under tension on Universal Testing Machine
5. To study the behavior of brittle material under tension on Universal Testing machine

6. To study the behavior of brittle material under compression on Universal Testing machine
7. To determine the modulus of rigidity of brass bar on torsion testing machine
8. To determine the impact strength of M.S./C.I. specimen on Izod impact testing machine.
9. To determine the impact strength of M.S./C.I. specimen on Charpy impact testing machine.
10. To determine Young's modulus of the material of a beam simply supported at the ends and carrying a concentrated load at the center

REFERENCE BOOKS

1. Strength of Materials by Sadhu Singh, Khanna Publishers
2. Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill Publication.
3. Fundamentals of Solid Mechanics by M L Gambhir, Prentice Hall of India
4. Strength of Materials Ramamurtham and Narayanan, S. Chand & Co.
5. Fundamentals of Structural Analysis B D Nautiyal, New Age Publishers

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	2	-	-	2	-	-
CO2	2	1	2	1	1	-	1	2	-	-	2	-	-
CO3	2	-	2	1	-	-	1	-	-	-	2	-	-

Fluid Mechanics Lab

Sem-III

General Course Information:

Course Code: PCC-CVE209-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course Outcomes

Sr.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Basic properties of fluids and its application.	L1 (Remembering)
CO2	Understand Various conditions in respect to the flow of fluids and the concept of floating bodies.	L2 (Understanding)
CO3	Analyze Flow measuring techniques and equipments with theories of fluid flow.	L4(Analyzing)
CO4	Formation of hydraulic models and modules and dimension analysis of fluids.	L6(Creating)

LIST OF EXPERIMENTS:

1 To determine meta-centric height of the ship model.

2 To verify the Bernoulli's theorem.

3 To determine coefficient of discharge for an Orifice-meter.

4 To determine coefficient of discharge of a venture-meter.

5 To determine the various hydraulic coefficients of an Orifice (C_d, Cc, Cv).

6 To determine coefficient of discharge for an Orifice under variable head.

7 To calibrate a given notch.

8 To determine coefficient of discharge for a mouth piece.

9 Drawing of a flow-net by Viscous Analogy Model and Sand Box Model.

10 To study development of boundary layer over a flat plate.

11 To study velocity distribution in a rectangular open channel.

12 Velocity measurements by current meter, float, double float (demonstration only).

13 Experiment on Vortex formation (demonstration only).

REFERENCES:

1. Fluid Mechanics and Hydraulic Machine by R. K. Bansal
2. Fluid mechanics and Fluid Power Engg. by D.S. Kumar
3. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
4. Hydraulics and Fluid Mechanics, P N Modi and S M Seth, Standard Book House
5. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
6. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	1	2	-	1
CO3	2	2	2	-	-	-	-	-	-	-	-	1	2	-	2
CO4	1	-	3	2	1	-	-	-	-	-	-	1	1	2	2

Design of Concrete Structures-I

Sem-IV

General Course Information:

Course Code: PCC-CVE202-T Course Credits: 3 Mode: Lecture (L:3) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the structural behavior of reinforced concrete elements	L1 (Remembering)
CO2	Explain the basic and application aspects of design of concrete structures	L2 (Understanding)
CO3	Apply the fundamental concepts of limit state method	L3 (Applying)
CO4	Analyze staircase and columns.	L4 (Analyzing)
CO5	Design beams, slab, stairs, columns and draw the reinforcement details.	L6 (Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Introduction- Plain and Reinforced concrete- Properties of concrete and reinforcing steel-Objectives of design-Different design philosophies- Working Stress and Limit State Methods-Limit State method of design-Introduction to BIS code-Types of limit states-characteristic and design values-partial safety factors-types of loads and their factors.

Limit State of Collapse in Bending-assumptions-stress-strain relationship of steel and concrete- analysis of singly reinforced rectangular beams-balanced-under reinforced-over reinforced sections-moment of resistance codal provisions.

UNIT-II

Design of Singly Reinforced Beams- basic rules for design- design example of simply supported beam- design of cantilever beam-detailing Analysis and design of doubly reinforced beams – detailing, T-beams- terminology- analysis of T beams- examples - Design for torsion-IS code approach- examples.

Design of slabs- introduction- one-way and two-way action of slabs - load distribution in a slab- IS recommendations for design of slabs- design of one-way slab- cantilever slab- numerical problems – concepts of detailing of continuous slab –code coefficients.

UNIT-III

Two- way slabs- simply supported and restrained slabs – design using IS Code coefficients Reinforcement detailing Limit State of Serviceability- limit state of deflection- short term and long-term deflection-IS code recommendations- limit state of cracking- estimation of crack width- simple numerical examples

UNIT-IV

Stair cases- Types-proportioning-loads- distribution of loads – codal provisions - design and detailing of dog legged stair- Concepts of tread-riser type stairs (detailing only)

Columns- introduction –classification- effective length- short column - long column - reinforcement-IS specifications regarding columns- limit state of collapse: compression -design of axially loaded short columns-design examples with rectangular ties and helical reinforcement.

REFERENCE BOOKS:

1. Design of Reinforced Concrete Structures-P. Dayaratnam-Oxford& IBH Pub.-N. Delhi.
2. Reinforced Concrete-Limit State Design- A.K. Jain- Nem Chand &Bros.-Roorkee.
3. Reinforced Concrete- I. C. Syal &A-K-Goel- A.H -Wheeler& Co. Delhi.
4. Reinforced Concrete Design- S.N. Sinha - TMH Pub.-N.Delhi.
5. SP-16(S&T)-1980- 'Design Aids for Reinforced Concrete to IS:456- BIS- N. Delhi.
6. SP-34(S&T)-1987 'Handbook on Concrete Reinforcement and Detailing'- BIS- N. Delhi.
7. Reinforced Concrete Design – Pillai and Menon- TMH- New Delhi.
8. Varghese P.C, Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt Ltd

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	2	1	-	1
CO2	1	1	1	-	-	-	-	-	-	-	-	2	1	-	1
CO3	2	2	2	-	-	-	-	-	-	-	-	1	-	-	1
CO4	2	2	3	-	-	-	-	-	-	-	-	2	2	1	3
CO5	2	2	3	-	-	-	-	-	-	-	-	2	3	1	3

Structural Analysis-I

Sem-IV

General Course Information:

Course Code: PCC-CVE204-T Course Credits: 3.5 Mode: Lecture (L-T: 3-1) Type: PCC Contact Hours: 3 hours (L), 1 (T) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

Sr.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Identify the method of analysis for determinate and indeterminate structures.	L2 (Understanding)
CO2	Understand the importance of various methods for analyzing the different structural members.	L3(Applying)
CO3	Examine the basic concepts of structural mechanics for the analysis arches	L4(Analysing)
CO4	Understand the concept of Cables and suspension Bridges with different support conditions.	L5(Evaluating)

Course Content

UNIT-I

Analysis of Indeterminate Structures: Degree of static and kinematic indeterminacies, analysis of indeterminate beams, pin jointed frames, rigid frames, reactions on statically indeterminate beams, pin jointed frames, rigid frames and trusses due to yielding of supports

UNIT-II

Shear force and Bending moment diagrams: Shear force and bending moment diagrams: simply supported, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, relationship between load, shear force and bending moment.

UNIT-III

Fixed and Continuous Beams: Analysis of fixed beams, continuous beams and propped cantilevers by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, effects of sinking and rotation of supports, slope and deflection of fixed beams, analysis of continuous beam by the three-moment theorem due to different types of loadings.

UNIT-IV

Arches: Analysis of two hinged and fixed arches. Three hinged arches: Horizontal thrust, shear force and bending moment diagrams.

Cables and suspension Bridges: Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, suspension bridge with two hinged and three hinged stiffening girders.

REFERENCE BOOKS

1. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2001.

2. C.K. Wang, Intermediate Structural Analysis, McGraw Hill, 1984.

3. B.G. Neal, Structural theorems and their application, Pergaman Press., 1972.

4. Bhavikatti, Structural Analysis Volume – I, Vikas Publishers, 3rd edition, 2008.

5. Timoshenko and Young, Theory of Structures, Publisher: Tata McGraw Hill, 2009.

6. Norries and Wilbur, Elementary Structural Analysis, Publisher: McGraw Hill, 1990.

7. Laursen H I, Structural Analysis, Publisher: McGraw Hill, 1988.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	1	-	-	-	1	-	-
CO2	1	-	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	2	2	-	-	-	1	-	-	-	-	2	-	-
CO4	2	-	2	2	-	-	-	-	1	-	-	-	1	-	-

Advanced Fluid Mechanics

Sem-IV

General Course Information:

Course Code: PCC-CVE206-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Illustrate drag and lift coefficients	**L2(Understanding)**
CO2	Demonstrate flow profiles in channel transitions and analyze hydraulic transients	**L3(Applying)**
CO3	Analyze compressible flows of liquids and gases	**L4(Analyzing)**
CO4	Design the working proportions of hydraulic machines	**L5(Evaluating)**
CO5	Design channels	**L6(Creating)**

Course Contents

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UNIT-I

Laminar Flow: Navier Stoke's equation, Laminar flow between parallel plates, Couette flow, laminar flow through pipes-Hagen Poiseuille law, laminar flow around a sphere-Stokes'law.

Flow through pipes: Types of flows-Reynold's experiment, shear stress on turbulent flow, boundary layer in pipes-Establishment of flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Stanton and Moody's diagram. Darcy's weisbach equation, other energy losses in pipes, loss due to sudden expansion, hydraulic gradient and total energy lines, pipes in series and in parallel, equivalent pipe, branched pipe, pipe networks, Hardy Cross method, water hammer.

Unit-II

Drag and Lift: Types of drag, drag on a sphere, flat plate, cylinder and airfoil, development of lift on immersed bodies like circular cylinder and airfoil.

Open Channel Flow: Type of flow in open channels, geometric parameters of channel section, uniform flow, most economical section (rectangular and trapezoidal), specific energy and critical depth, momentum in open channel, specific force, critical flow in rectangular channel, applications of specific energy and discharge diagrams to channel transition, metering flumes, hydraulic jump in rectangular channel, surges in open channels, positive and negative surges, gradually varied flow equation and its integration, surface profiles.

Unit-III

Compressible flow: Basic relationship of thermodynamics continuity, momentum and energy equations, propagation of elastic waves due to compression of fluid, Mach number and its significance, subsonic and supersonic flows, propagation of elastic wave due to disturbance in fluid mach cone, stagnation pressure.

Unit-IV

Pumps and Turbines: Reciprocating pumps, their types, work done by single and double acting pumps. Centrifugal pumps, components and parts and working, types, heads of a pump-statics and manometric heads,. Force executed by fluid jet on stationary and moving flat vanes, Turbines-classifications of turbines based on head and specific speed, component and working of Pelton wheel and Francis turbines, cavitation and setting of turbines.

REFERENCE BOOKS:

1 Fluid Mechanics and Hydraulic Machines , Mahesh Kumar, Pearson Education, 2019

2 Hydraulics & Fluid Mechanics by P.N.Modi and S.M.Seth

2. Fluid Mechanics by R. K. Bansal

3. Flow in Open Channels by S.Subraminayam

4. Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	2	2	-	2
CO4	2	2	3	-	-	-	-	-	1	-	-	2	2	-	2
CO5	2	2	3	-	-	-	-	-	1	-	-	2	2	-	2

Environmental Engineering

Sem-IV

General Course Information:

Course Code: PCC-CVE208-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

S.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Know about the structure of drinking water supply systems, including water transport.	L1 (Remembering)
CO2	Understand the water quality criteria and standards, and their relation to public health	L2 (Understanding)
CO3	Analyze the process of construction, operation and maintenance of Water Treatment Plants	L4(Analyzing)
CO4	Design and evaluate water supply project alternatives on basis of chosen selection criteria	L6(Creating)

Course Content

UNIT-I

Public water supply system-Planning-Objectives-Design Period-Population Forecasting-Water Demand-Sources of water and their characteristics-Surface and Groundwater-Impounding Reservoir Well Hydraulics-Development and selection of source-Water Quality-Characterization and standards-Impact of climate change.

UNIT-II

Water supply-intake structures-Functions and drawings-Pipes and conduits for water-Pipe Materials-Hydraulics of flow in pipes-Transmission main design-Laying, jointing and testing of pipes-Drawings Appurtenances-Types and capacity of pumps-Selection of pumps and pipe materials.

UNIT-III

Objectives-Unit operations and processes - Principles, functions design and drawing of Chemical feeding, Flash mixers, flocculators, sedimentation tanks and sand filters – Disinfection – Residue Management-Construction and Operation & Maintenance aspects of Water Treatment Plants.

UNIT-IV

Principles and functions of Aeration-Iron and manganese removal, Defluoridation and demineralization-Water softening - Desalination-Membrane Systems-Recent advances.

TEXT BOOKS:

1. Garg, S.K., "Environmental Engineering", Vol.1 Khanna Publishers, New Delhi, 2005.
2. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.
3. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2005

REFERENCES:

1. Government of India, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, New Delhi, 2003
2. Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning", Design and Operation, Prentice Hall of India Private Limited, New Delhi, 2006. Visit www.padeepz.net for notes an

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	1	1	2	-	-	-	-	2	1	-	2
CO2	2	1	2	1	-	1	2	-	-	-	-	2	1	-	2
CO3	2	2	3	1	-	1	2	-	-	-	-	2	1	-	3
CO4	2	2	3	1	1	1	2	-	-	-	-	2	1	2	3

Concrete Technology

Sem-IV

General Course Information:

Course Code: PCC-CVE210-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

S.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Identify the functional role of ingredients of concrete	L1 (Remembering)
CO2	Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete.	L2 (Understanding)
CO3	Analyze the effect of chemicals on concrete and use of concrete in special conditions	L4(Analyzing)
CO4	Design a concrete mix which fulfills the required properties for fresh and hardened concrete	L6(Creating)

UNIT – I

Constituents of Concrete: Properties of Cement, Tests on cement, Various types of cement & their applications, Bulking of Sand, properties of good sand and functions of sand in mortar and cement concrete, substitutes of sand, Classification of Aggregates, Properties of aggregates – specific gravity, bulk density, porosity, adsorption & moisture content of aggregates, deleterious substance in aggregate, Soundness of aggregate, Grading of coarse and fine aggregates, physical requirements of aggregates, and their tests.

Chemical and Mineral Admixtures: their purpose, their types, properties, dosages, effects and usages.

UNIT – II

Properties of Fresh and Hardened Concrete: Properties & Tests of Cement Concrete, Workability, factors affecting workability, measurement of workability by different tests; Strength of concrete and factors affecting it, Water Cement Ratio – Abram's law, Degree of Compaction and Age of Concrete. Development of Strength of Concrete, Methods of Curing, Influence of Temperature, Steam curing.

UNIT – III

Durability of Concrete: Durability, shrinkage & Creep of Concrete, Factors influencing Creep; Compression tests and Tension Tests, Flexural Tests & Splitting Tests, Freeze and Thaw in Concrete. Sulphate attack of concrete, Corrosion of rebar w.r.t chloride and sulphate attack, Alkali Silica Reaction, Freezing and Thawing, Carbonation of Concrete, Corrosion Measurement Techniques, Prevention of Corrosion

UNIT – IV

Concrete Mix Design: Principles of Concrete Mix Design, Basic Considerations, Factors in the choice of mix design, outline of mix design procedure, Design of concrete mixes as per IS:10262:2009.

Special Circumstances of Concreting: Hot weather concreting, Cold weather concreting, Underwater concreting, Heavy Concrete, Lightweight Concrete

REFERENCE BOOKS

1. Concrete Technology, by A. M. Neville & J.J. Brooks, Pearson.
2. Concrete Technology, by M. L. Gambhir, Tata McGraw Hill, New Delhi.
3. Concrete Technology, by M.S. Shetty, S. Chand & Co.
4. Handbook of Mix Design, BIS, New Delhi.
5. Concrete Technology, by A.R. Santhakumar, Oxford University Press.
6. Concrete Microstructure and its Properties by P K Mehta and PJM Monterio
7. IS: 269 1989
8. IS:383 1970
9. IS:10262 2009

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	1	1	-	-	1	-	1
CO2	1	-	-	-	-	1	-	1	-	-	-	1	-	1
CO3	2	2	2	2	1	1	1	1	1	-	1	2	1	2
CO4	2	2	2	2	1	1	1	1	2	-	2	2	2	2

Design of Concrete Structures-I Lab

Sem-IV

General Course Information:

Course Code: PCC-CVE202-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

S. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand the structural drawings of various building components	L2(Understanding)
CO2	Apply the coding provisions of Indian Standards for detailing	L3(Applying)
CO3	Use the AUTOCAD software tool for drawing concrete structures	L4(Analyzing)
CO4	Evaluate drawings of concrete structures	L5 (Evaluating)
CO5	Design concrete structures using AUTOCAD software	L6 (Creating)

Structural Drawings through AUTOCAD of the followings

1. Singly reinforced concrete beams
2. Doubly reinforced concrete beams

3. Cracking pattern of reinforced concrete beams
4. Simply supported and cantilever slabs
5. Flat slabs
6. Two-way slabs
7. Columns.
8. Footings.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	-	-	-	-	-	-	-	1	1	-	-
CO2	1	-	2	1	-	-	-	-	-	-	-	1	1	-	-
CO3	2	-	-	1	3	-	-	-	-	-	-	2	2	2	-
CO4	1	-	2	2	-	-	-	-	-	-	-	1	3	-	-
CO5	2	-	3	2	3	-	-	-	-	-	-	2	3	3	-

Structural Analysis-I Lab

Sem-IV

General Course Information:

Course Code: PCC-CVE204-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course Outcomes

Sr.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Basic application of mechanics involved commonly in the structures.	L1 (Remembering)
CO2	Apply the process of agitation on the structures.to get the desired values of the resultant action	L3 (Applying)
CO3	Various techniques to analyse the structures following the slope and deflection approach.	L4(Analyzing)
CO4	Formulate trusses or forces in each member of trusses using simplified approach.	L6(Creating)

LIST OF EXPERIMENTS:

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss- horizontal deflection & vertical deflection of various joints of a pin-jointed truss.

4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
6. Experimental and analytical study of behavior of struts with various end conditions.
7. To determine elastic properties of a beam.
8. Uniaxial tension test for steel (plain & deformed bars)
9. Uniaxial compression test on concrete & bricks specimens

Text Books:

1. Experimental Methods in Structural Mechanics Kukreja C B and Sastry V V
2. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2001.
3. C.K. Wang, Intermediate Structural Analysis, McGraw Hill, 1984.
4. B.G. Neal, Structural theorems and their application, Pergaman Press., 1972.
5. Bhavikatti, Structural Analysis Volume – I, Vikas Publishers, 3rd edition, 2008

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-	1
CO3	2	2	1	1	1	-	-	-	-	-	-	-	2	1	2
CO4	2	2	1	2	1	-	-	-	-	-	-	-	2	2	3

Advanced Fluid Mechanics Lab

Sem-IV

General Course Information:

Course Code: PCC-CVE206-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

S. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO 1	Explain basic properties of fluids and its application.	L2(Understanding)
CO 2	Employ various conditions in respect to the flow of fluids and the concept of floating bodies.	L3(Applying)
CO 3	Examine properties and functioning of centrifugal pump.	L4(Analyzing)
CO 4	Determine the flow in various pipe fittings.	L5(Evaluating)
CO 5	To develop the momentum characteristics of a given jet.	L6(Creating)

LIST OF EXPERIMENTS:

1 To determine the coefficient of drag by Stoke's law for spherical bodies.

2 To study the phenomenon of cavitation in pipe flow.

3 To determine the critical Reynold's number for flow through commercial pipes.

4 To determine the coefficient of discharge for flow over a broad crested weir.

5 To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.

6 To study the scouring phenomenon around a bridge pier model.

7 To study the scouring phenomenon for flow past a spur.

8 To determine the characteristics of a centrifugal pump.

9 To study the momentum characteristics of a given jet.

10 To determine head loss due to various pipe fittings.

REFERENCE BOOKS:

1. Hydraulics & Fluid Mechanics by P.N.Modi and S.M.Seth
2. Fluid Mechanics by R. K. Bansal
3. Flow in Open Channels by S.Subraminayam
4. Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	-	-	-	-	-	-	-	1	1	-	1
CO2	2	1	1	2	-	-	-	-	-	-	-	1	1	-	1
CO3	2	2	2	2	-	-	-	-	-	-	-	2	1	-	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	-	3
CO5	2	2	2	2	-	-	-	-	-	-	-	2	2	-	3

Environmental Engineering. Lab

Sem-IV

General Course Information

Course Code: PCC-CVE208-P Course Credits: 1 Mode: PRACTICAL(P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Identify physical, chemical and biological characteristics of water and wastewater	L2(Understanding)
CO2	Solve optimum dosage of coagulant	L3(Applying)
CO3	Evaluate break - point chlorination	L5(Evaluating)
CO4	Formulate the quality of water and wastewater	L6(creating)

*Revised Bloom's Taxonomy

Detailed Syllabus:

1. Determination of pH.

2. Determination of Conductivity.

3. Determination of Acidity of waste water.

4. Determination of Alkalinity of waste Water.

5. Determination of Chlorides.

6. Determination of Hardness of waste water.

7. Determination of Fluorides in waste water

8. Determination of Available Chlorine in bleaching powder.

9. Conducting Break Point Chlorination Test.

10. Determination of Residual Chlorine.

11. Determination of Dissolved Oxygen.

12. Determination of Chemical Oxygen Demand of waste water

13. Determination of Biochemical Oxygen Demand of waste water

14. Conducting Jar test for determining optimum dosage of coagulant.

15. Determination of Total Solids, Total Dissolved Solids & Settelable Solids.

REFERENCE BOOKS

Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	1	1	2	-	-	-	-	2	1	1	2
CO2	2	2	3	1	-	1	2	-	-	-	-	2	1	-	2
CO3	2	2	3	1	-	1	2	-	-	-	-	2	1	-	3
CO4	2	2	3	1	1	1	2	-	-	-	-	2	1	2	3

Concrete Technology Lab

Sem-IV

General Course Information:

Course Code: PCC-CVE210-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course Outcomes

Sr.No.	Course Outcome At the end of the course, students will be able to:	RBT* Level
CO1	Demonstrate properties of cement	L1(Remembering)
CO2	Demonstrate grading of aggregates	L2(Understanding)
CO3	Differentiate properties of concrete	L4(Analyzing)
CO4	Demonstrate workability of concrete	L6(Creating)

List of Experiments:

1. To determine standard consistency, initial and final setting times of cement
2. To determine compressive strength of cement
3. To determine the soundness of cement.
4. To determine the specific gravity of cement

5. To determine specific gravity of fine aggregate & coarse aggregate
6. To determine the slump value of a prepared concrete mix (Slump test)
7. To determine the grading of fine aggregate & coarse aggregate
8. To determine the water absorption and moisture content of fine aggregate
9. To determine the water absorption and moisture content of coarse aggregate
10. To determine the compressive, tensile and flexural strengths of concrete
11. To design a mix grade of concrete as per Indian standard IS:10262 2009
12. Non-Destructive Testing- Rebound Hammer Test

Text Books

1. Material Testing Laboratory manual Kaushik S K, Kukreja CB Gupta VK and Kishore K. Standard Publishers Distributors
2. Concrete Laboratory Manual M. L. Gambhir

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	1	2	3	3	-	1	1	-	1
CO2	3	-	-	-	-	2	1	2	3	3	-	1	1	-	1
CO3	3	-	-	-	-	2	1	2	3	3	-	1	2	1	2
CO4	3	-	-	-	-	2	1	2	3	3	-	1	3	2	3

Irrigation and Water Resource Engineering

Sem -V

General Course Information

Course Code: PCC-CVE301-T Course Credits: 2 Mode: Lecture (L) Type: PCC Contact Hours: 2 hours Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	State and outline the concepts of Hydrology	L1 (Remembering)
CO2	Understand the basics of groundwater and hydraulics of subsurface flows.	L2 (Understanding)
CO3	Illustrate abstractions from precipitation	L3 (Applying)
CO4	Analyze the soil water relationship and irrigation methods	L4 (Analyzing)
CO5	Plan and design Irrigation System (Canal network, irrigation structures, diversion head works etc.)	L6 (Creating)

*Revised Bloom's Taxonomy

Course Content

UNIT-I

HYDROLOGY: Hydrologic cycle, Precipitation: introduction, forms of precipitation, types of precipitation, measurement of precipitation, selection of rain gauge station. Hyetograph and mass curve of rainfall, Evaporation: Definition, factors affecting, measurement, evaporation control. Evapo-transpiration, Infiltration.

Definition, components of hydrographs, unit hydrograph, base flow separation, Prepositions of unit hydrograph-problems.

UNIT-II

Soil-water relationship and irrigation methods: Soil-water relationship, root zone soil water, infiltration, consumptive use, field capacity, wilting point, available moisture in soil, Gross Command Area, Culturable Command Area, intensity of irrigation, delta, base period, Kor depth, core period, frequency of irrigation, duty of water, relation between delta, duty and base period, irrigation requirement,

Methods of Irrigation-flooding methods, border strip method, check basin and furrow method, assessment of irrigation water, sprinkler irrigation system.

UNIT-III

Cross Drainage Works: Classification and their selection, Hydraulic Design Aspects of Aqueducts, Syphon Aqueducts, Super Passage, Canal Syphon and Level Crossing, Design of Canal Transitions.

Diversion Canal Headworks: Various components and their functions, layout plan, selection of site for diversion headworks, causes of failure of weir/barrages on permeable foundation, Bligh's creep theory, Khosla's method of independent variables, use of Khosla's curves, various corrections.

UNIT-IV

Regulation works: Canal falls-necessity and location, development of falls, design of cistern element, roughening devices. Design of Sarda type fall. Design of straight Glacis fall. Off-take alignment, Cross-Regulator and Distributary Head Regulators, devices to control silt entry into the off-taking channel and Silt Ejector, Canal Escapes.

Reference Books

1. Irrigation, Water Resources and Water Power Engg. By P.N.Modi.
2. Fundamentals on Irrigation Engg. by Bharat Singh
3. Irrigation Engg& Hydraulic Structures by S.K.Garg.
4. Irrigation Engg. by S.K.Sharma.
5. Garg S.K., Hydrology and Water Resources Engineering
6. Subramanya, K., Engineering Hydrology, Tata McGraw Hill, New Delhi.
7. Raghunath, H.M., Groundwater, 1987, Wiley Eastern Ltd., New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	1	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	-	-	1	-	-	-	-	-	-	-	-	-	1	1
CO4	2	2	2	2	-	-	-	-	-	-	-	1	1	1	1
CO5	2	2	2	3	-	-	-	-	-	-	-	1	1	2	3

Structural Analysis-II

Sem-V

General Course Information:

Course Code: PCC-CVE303-T Course Credits: 3.5 Mode: Lecture (L-T-3-1) Type: PCC Contact Hours: 4 hours (L) Examination Duration: 03 Hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Analyze the behavior of beams and frames during uneven support settlements.	L2(Understanding)
CO2	Apply Slope deflection and moment Distribution Methods	L3(Applying)
CO3	Column Analogy Method in structural analysis	L4(Analyzing)
CO4	Evaluate bending stresses in beam subjected to Unsymmetrical Bending	L5(Evaluating)

Course Content

UNIT-I

Slope and Deflection Method: Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements.

UNIT-II

Moment Distribution Method: Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements, symmetrical beams and frames with symmetrical, skew-symmetrical and general loading.

UNIT-III

Column Analogy Method: Elastic center, Properties of analogous column, Applications to beam & frames.

Kani's Method: Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports, symmetrical beams and frames, general case- storey columns unequal in height and bases fixed or hinged.
Approximate Analysis of Frame: Vertical and lateral load analysis of multistory frames, portal, cantilever and substitute-frame methods and their comparison.

UNIT-IV

Unsymmetrical Bending: Introduction Centroidal principal axes of sections, bending stresses in beam subjected to unsymmetrical bending, shear center, shear center for channel, Angles and Z sections.

Space Frames: Introduction, simple space truss, types of supports, equilibrium and stability conditions, analysis of determinate and indeterminate space frames using tension coefficient method.

Reference Books:

1. Statically Indeterminate Structures, C.K. Wang, McGraw Hill Book Co., New York
2. Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee
3. Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi
.
4. Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	1	2	-	-
CO4	2	2	3	1	-	-	-	-	-	-	-	1	3	1	-

Surveying –II

Sem-V

General Course Information:

Course Code: PCC-CVE305-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand mathematical adjustment of accidental errors involved in surveying measurements	L2(Understanding)
CO2	Carry out a geodetic survey, taking accurate measurements using instruments and adjusting the traverse	L3(Applying)
CO3	Plan a survey for applications such as road alignment and height of the building	L4(Analyzing)
CO4	Interpret survey data and plot topographical maps	L5 (Evaluation)
CO5	Create height maps and contours using photogrammetric measurements	L6 (Creating)

Course Contents

UNIT-I

Trigonometrical Levelling: Introduction, height and distances-base of the object accessible, base of object inaccessible, geodetical observation, refraction and curvature, axis signal correction, difference in elevation between two points.

Triangulation: Triangulation systems, classification, strength of figure, selection of triangulation stations, grade of triangulation, field work of triangulation, triangulation computations, introduction to E.D.M. instruments.

UNIT-II

Survey Adjustment and Treatment of Observations: Types of errors, definition of weight of an observation, most probable values, law of accidental errors, law of weights, determination of probable error (different cases with examples) principle of least squares, adjustment of triangulation figures by method of least squares.

UNIT-III

Astronomy: Definitions of astronomical terms, star at elongation, star at prime vertical star at horizon, star at culmination, celestial coordinate systems, Napier's rule of circular parts, various time systems: sidereal, apparent, solar and mean solar time.

UNIT-IV

Elements of Photo-grammetry: Introduction: types of photographs, types of aerial photographs, aerial camera and height displacements in vertical photographs, stereoscopic vision and stereoscopies, height determination from parallax measurement, flight planning

Introduction of remote sensing and its systems, Concept of G.I.S and G.P.S. -Basic Components, data input, storage & output.

REFERENCE BOOKS:

1. Surveying Vol.2 by S.K Duggal
2. Surveying Vol.2 by B.C.Punmia
3. Surveying Vol.3 by B.C.Punmia
4. Surveying Vol2 by T.P.Kanitkar
5. Higher Surveying by A M Chandra

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	-	-	-	-	-	1	2	1	1	1
CO2	2	2	2	2	2	-	-	-	-	-	1	2	1	2	2
CO3	2	2	2	2	2	-	-	-	-	-	1	2	2	3	3
CO4	2	2	2	2	2	-	-	-	-	-	1	2	3	3	3
CO5	3	2	2	2	2	-	-	-	-	-	1	2	3	3	3

Design of Concrete Structures-II
Sem V

General Course Information

Course Code: PCC-CVE307-T Course Credits: 3.5 Mode: Lecture (L-T-3-1) Type: PCC Contact Hours: 4 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand types of foundations	L2(Understanding)
CO2	Gain knowledge of prestressed concrete fundamentals and analyze pre and post tensioned beams.	L3(Applying)
CO3	Design and detail circular slabs and domes	L4 (Analyzing)
CO4	Design rectangular and circular water tanks using IS code coefficients (IS 3370).	L6 (Creating)

*****Revised Blooms Taxonomy

UNIT-I

Foundations-Classification-IS code provisions for design of isolated footings- design principles of rectangular footings-Design of rectangular footings-uniform thickness and sloped- eccentrically loaded rectangular footing of uniform thickness-detailing. Combined footings- analysis of combined footings-rectangular and trapezoidal.

UNIT-II

Retaining walls-Types- Cantilever retaining wall- earth pressure and forces acting-stability-proportioning-structural behavior of components -design example of cantilever retaining wall without surcharge-detailing Counterfort retaining wall- design principles of components and detailing

UNIT-III

Circular slabs- stresses- reinforcements- simply supported, fixed and partially fixed subjected to uniformly distributed loads Design and detailing of spherical and conical domes.

UNIT-IV

Introduction to design of water tanks-design philosophy and requirements-joints- IS code recommendations Design of rectangular water tanks using IS code coefficients (IS 3370). Design of circular water tanks using- IS code coefficients (IS 3370)

Introduction to Pre-stressed concrete: Concept of pre-stressing Materials-High strength concrete and high tensile steel.

Text Books

1. Reinforced Concrete Structures, P. C. Varghese, Tata McGraw Hill
2. Advanced Reinforced Concrete Structures, P. C. Varghese, Tata McGraw Hill
3. Limit State Design of Reinforced Concrete, A.K. Jain, Nem Chand and Bros., Roorkee
4. Plain and Reinforced concrete, Vol. 2, O P Jain and J. Krishna, Nem Chand and Bros., Roorkee
5. Reinforced Concrete Design, S U Pillai and D Menon, Tata McGraw Hill
6. Relevant IS codes (IS 456, IS 875IS 1343, IS 3370, SP 16, SP 34)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	-	-	-	1	1	1	1
CO2	2	2	2	1	1	-	-	-	-	-	-	1	1	1	1
CO3	2	2	2	1	1	-	-	-	-	-	-	1	1	1	2
CO4	2	2	2	2	1	-	-	-	-	-	-	1	2	2	3

Structural Analysis-II Lab

Sem-V

General Course Information:

Course Code: PCC-CVE303-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Basic application of mechanics involved commonly in the structures.	L2(Understanding)
CO2	Get the desired values of the resultant action in response to the agitation on the structures.	L3(Applying)
CO3	Various techniques to analyze the structures following the slope and deflection approach.	L4(Analyzing)
CO4	Evaluation of trusses or forces in each member of trusses using simplified approach.	L5(Evaluating)
CO5	Develop qualitative diagrams showing the displaced shape, bending moments	L6(Creating)

LIST OF EXPERIMENTS:

1. Experiment on a two hinged arch for horizontal thrust & influence line for Horizontal thrust
2. Experimental and analytical study of a 3-bar pin-jointed Truss.
3. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.
4. Experimental and analytical study of an elastically coupled beam.
5. Sway in portal frames - demonstration.
6. To study the cable geometry and statics for different loading conditions.
7. To plot stress-strain curve for concrete.

Reference Books:

1. Statically Indeterminate Structures, C.K. Wang, McGraw Hill Book Co., New York
2. Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee
3. Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi
.
4. Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	1	-	-	-	-	1	1	-	-
CO2	1	1	1	1	-	-	-	-	-	-	-	1	2	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	1	2	1	-
CO4	2	1	2	1	-	-	-	-	-	-	-	1	1	1	-
CO5	2	1	2	1	-	-	-	-	-	-	-	1	1	1	-

Surveying-II Lab

Sem-V

General Course Information:

Course Code: PCC-CVE305-P Course Credits: 1 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand Theodolite along with chain/tape, compass on the field	L2(Understanding)
CO2	Apply Geometric and trigonometric principles of basic surveying calculations	L3(Applying)
CO3	Plan survey, taking accurate measurements, filed booking, plotting and adjustment of errors	L4(Analyzing)
CO4	Evaluate various types of surveys, as part of surveying team	L5(Evaluating)
CO5	Create drawing techniques in the development of topographic map	L6(Creating)

LIST OF EXPERIMENTS:

1. Theodolite Surveying

2. Single Plane observation of trigonometrically leveling
3. Two Plane Method
4. Determination of tachometric constants
5. Tangent Tachometry
6. Subtense Bar
7. Use of Total Station, DGPS etc.

REFERENCE BOOKS:

1. Surveying Vol.2 by B.C.Punmia
2. Surveying Vol.3 by B.C.Punmia
3. Surveying Vol2 by T.P.Kanitkar
4. Higher Surveying by A M Chandra

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	1	1	-	1
CO2	2	1	1	1	-	-	-	-	-	-	-	1	2	-	1
CO3	1	-	2	1	1	-	-	-	-	-	-	2	3	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	1	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	2	1	2	2

Software Lab-I

Sem-V

General Course Information:

Course Code: PCC-CVE309-P Course Credits: 0 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P)	**Course Assessment Methods (Internal: 50)** The internal assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, and ethical practices followed. There will be a continuous process for laboratory course evaluation and will be done by the internal examiner

S. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand the structural drawings of various building components	L2(Understanding)
CO2	Apply the coding provisions of Indian Standards for detailing	L3(Applying)
CO3	Use the AUTOCAD software tool for drawing	L4(Analyzing)
CO4	Evaluate drawings of structures using STAAD PRO CONNECT	L5 (Evaluating)
CO5	Design structures using STAAD PRO CONNECT software	L6 (Creating)

Introduction to Civil Engineering Softwares like STAAD PRO CONNECT, AUTOCAD and ArcGIS.

Students will be able to do:

1. Draw a Plan of 2-BHK House using AUTOCAD
2. Draw structural members such as Door, Window, Footings etc.
3. Analysis of Beams with different support conditions and loading conditions
4. Analysis of 2- D Portal Frame for vertical and horizontal loading using STAAD PRO CONNECT.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	-	-	-	-	-	-	-	1	1	1	-
CO2	1	-	2	1	-	-	-	-	-	-	-	1	1	-	-
CO3	2	-	-	1	3	-	-	-	-	-	-	2	2	2	-
CO4	1	2	2	2	3	-	-	-	-	-	-	1	3	3	-
CO5	2	2	3	2	3	-	-	-	-	-	-	2	3	3	-

Transportation Engineering -I

Sem -VI

General Course Information:

Course Code: PCC-CVE302-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand Different modes of Transportation	**L2(Understanding)**
CO2	Perform geometric design of highways	**L3(Applying)**
CO3	Perform analysis and design of flexible and rigid pavements	**L4(Analyzing)**
CO4	Evaluate Spot Speed and Speed & Delay	**L5(Evaluating)**
CO5	Perform the traffic studies before making changes to or designing new road	**L6(Creating)**

Course Content

UNIT-I

General: Different modes of transport, Development of Transport System, Phased development of Roads in India.

Planning of Highways: Planning & Management of Highways, Various Road plans developed in India, Road pattems, Highway Surveys & Alignment, Design, Drawings, Estimates & Project Report.

UNIT-III

Geometric Design of Highways: Introduction, Highways Classification, right of way, Land width, width of formation, Thickness of pavement, Sight Distances, stopping sight distance, overtaking sight distance, overtaking zones, camber, Road Curves, Transition Curves, Super elevation. Widening at curves, IRC-recommendations for various geometric design parameters.

UNIT-III

Pavements: Types and component parts of pavements, Factors affecting design of pavements. Structure of Flexible pavement and Overview of design procedure as per IRC 37:2001, 2012 and IRC72: 2007, Construction of Cement Concrete Roads & its layer specifications, Overview of design of PQC pavements as per IRC 58 & SP 062.

Failures of flexible and rigid pavements: Causes of Failures and Remedial Measures, Maintenance of flexible and rigid pavements, pavement evaluation and its strengthening.

UNIT-IV

Traffic Studies: Definition of Traffic Engineering, Vehicular characteristics, Road user characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Traffic accident studies, Causes of accidents and Remedial Measures, Parking studies.

REFERENCE BOOKS:

1. Khanna S.K. and C.E.G. Justo, Highway Engineering, Nemchand Bros(2012)
2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee (2004).
3. Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (2010)
4. Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi (1999)
5. Yoder E. J.; Principles of Pavement Design, John Wiley & Sons (1975).

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	1	1	1	-	-	-	-	-	1	-	1	1	1	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	1	2	-	1
CO4	2	1	2	1	-	-	-	-	-	-	2	1	1	-	1
CO5	1	1	2	2	-	-	-	-	1	-	2	1	1	-	1

Sewage Treatment
Sem -VI

General Course Information

Course Code: PCC-CVE304-T Course Credits: 2 Mode: Lecture (L) Type: PCC Contact Hours: 2 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the concepts of sewage and sewage treatment	L2 (Understanding)
CO2	Apply environmental treatment technologies for sewage treatment	L3 (Applying)
CO3	Characterization of sewage using various parameters and methods	L4 (Analyzing)
CO4	Assess appropriate methods for sewage treatment	L5 (Evaluating)
CO5	Plan, design and operations of sewerage system and sewage treatment plant	L6 (Creating)

*Revised Bloom's Taxonomy

Course Content

UNIT-I

Collection of sewage: Importance of sanitation, Systems of sewerage – separate, combined and partially separate. Quantity of sanitary sewage and variations. Shapes of sewer – circular and egg shaped. Design of sewers, self-cleansing velocity and slopes, Construction and testing of sewer lines. Sewer materials. joints and appurtenances.

UNIT-II

Sewage Characterization: Physical, Chemical and biological parameters, Quality parameters- BOD, COD, Solids, D.O., Oil & Grease. Indian Standards for disposal of effluents into inland surface sources and on land.

UNIT-III

Sewage Treatment: Objectives, sequence and efficiencies of conventional treatment units. Preliminary treatment, screening and grit removal units. Theory and design aspects of primary treatment, secondary treatment- activated sludge process & its modifications, Tricking filter, sludge digestion and drying beds. Stabilization pond, aerated lagoon, septic tank and Imhoff tank.

UNIT-IV

Disposal of Sewage: Disposal of sewage by dilution – self-purification of streams. Sewage disposal by irrigation (sewage treatment).

REFERENCE BOOKS:

1. Waste Water Engineering: Metcalf and Eddy.
2. Sewage and Sewage Treatment: S.K. Garg.
3. Sewage and Sewage Treatment: S.R. Krishansagar.
4. Waste Water Engineering: B.C. Punmia.
5. Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	2	1	1	-	-	-	1	-	-	-
CO2	2	2	1	1	-	2	2	-	-	-	-	2	-	-	-
CO3	2	2	1	1	-	-	1	1	-	-	-	2	1	-	-
CO4	2	3	1	3	-	1	2	-	-	-	-	2	1	-	2
CO5	2	2	3	2	-	2	2	2	1	-	-	2	3	-	2

Soil Mechanics

Sem -VI

General Course Information

Course Code: PCC-CVE306-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Describe and discuss basic concepts of soil properties and soil mechanics	L2 (Understanding)
CO2	Classify and determine the index and engineering properties of soil	L3 (Applying)
CO3	Apply the basic concepts of soil mechanics in civil engineering works	L3 (Applying)
CO4	Examine the permeability and compressibility characteristics of soils in engineering practices	L4 (Analyzing)
CO5	Evaluate earth pressures and apply to check external stability of retaining structures	L5 (Evaluating)

*Revised Bloom's Taxonomy

UNIT-I

Soil Formation and Composition: Introduction, soil and rock, Soil Mechanics and Foundation Engineering, origin of soils, weathering, soil formation, major soil deposits of India, particle size, particle shape, inter particle forces, soil structure, principal clay minerals.

Basic Soil Properties: Introduction, three phase system, weight-volume relationships, soil grain properties, soil aggregate properties, grain size analysis, sieve analysis, sedimentation analysis, grain size distribution curves, consistency of soils, consistency limits and their determination, activity of clays, relative density of sands.

Classification of soils: Purpose of classification, classification on the basis of grain size, classification on the basis of plasticity, plasticity chart, Indian Standard Classification System.

Permeability of Soils: Introduction, Darcy's law and its validity, discharge velocity and seepage velocity, factors affecting permeability, laboratory determination of coefficient of permeability, determination of field permeability, permeability of stratified deposits.

UNIT-II

Effective Stress Concept: Principle of effective stress, effective stress under hydrostatic conditions, capillary rise in soils, effective stress in the zone of capillary rise, effective stress under steady state hydro-dynamic conditions, seepage force, quick condition, critical hydraulic gradient, two dimensional flow, Laplace's equation, properties and utilities of flownet, graphical method of construction of flownets, piping, protective filter.

Compaction: Introduction, role of moisture and compactive effect in compaction, laboratory determination of optimum moisture content, moisture density relationship, compaction in field, compaction of cohesionless soils, moderately cohesive soils and clays, field control of compaction

UNIT-III

Compressibility and Consolidation: Introduction, components of total settlement, consolidation process, one-dimensional consolidation test, typical void ratio-pressure relationships for sands and clays, normally consolidated and over consolidated clays, Casagrande's graphical method of estimating pre-consolidation pressure, Terzaghi's theory of one-dimensional primary consolidation, determination of coefficients of consolidation, consolidation settlement, Construction period settlement, secondary consolidation

UNIT-IV

Shear Strength: Introduction, Mohr stress circle, Mohr-Coulomb failure-criterion, relationship between principal stresses at failure, shear tests, direct shear test, unconfined compression test, triaxial compression tests, drainage conditions and strength parameters, Vane shear test, shear strength characteristics of sands, normally consolidated clays, over-consolidated clays and partially saturated soils, sensitivity and thixotropy.

Earth Pressure: Introduction, earth pressure at rest, Rankine's active & passive states of plastic equilibrium, Rankine's earth pressure theory, Coulomb's earth pressure theory, Culmann's graphical construction, Rebhann's construction.

REFERENCE BOOK:

1 Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New Age Intetrnational(P)Ltd.Pub.N.Delhi.

2 Soil Mechanics and foundation engineering by Dr. K. R. Arora.

3. Soil Engg. in Theory and Practice, Vol .I, Fundamentals and General Principles by Alam Singh, CBS Pub.,N.Delhi.

4. Engg.Properties of Soils by S.K.Gulati, Tata-Mcgraw Hill,N.Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	1	1	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	2	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	1	2	1	-	-
CO4	2	2	2	3	-	-	-	-	-	-	1	2	1	-	-
CO5	2	3	3	3	-	-	-	-	-	-	1	2	1	-	2

Design of Steel Structures-I
Sem -VI

General Course Information:

Course Code: PCC-CVE308-T Course Credits: 3.5 Mode: Lecture (L-T:3-1) Type: PCC Contact Hours: 3 hours (L), 1(T) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand various aspects of the designs of steel structures	L2 (Understanding)
CO2	Apply the IS codes of practice for the design of steel structural elements.	L3 (Applying)
CO3	Analyze and design the behavior of various connections for both axial and eccentric forces.	L4 (Analyzing)
CO4	Assess loads on truss and design purlins	L4 (Analyzing)
CO5	design tension members and beams using the IS specifications	L6(Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Introduction to steel and steel structures, properties of steel, structural steel sections. Introduction to design: Design loads and load combinations, limit state design concepts. Connections bolted and welded

UNIT-II

Tension members-Types of sections – net area- design of tension members- concept of shear lag-use of lug angle-connections in tension members

Compression members- design of struts- solid and built-up columns for axial loads-- design of lacings and battens-column bases- slab base – gusseted base

UNIT-III

Design of beams- laterally restrained and unrestrained – simple and compound beams- plate girders subjected to uniformly distributed loads – design of stiffeners.

UNIT-IV

Gantry Girders: Introduction- various loads- specifications- design of gantry girder.

Design of roof trusses- types-design loads and load combinations-assessment of wind loads- design of purlins. Moment resistant/Eccentric connections

REFERENCE BOOKS:

1. Duggal- S.K. Limit State Design of Steel structures- McGraw Hill (2009.)
2. Ajmani- A. L. and Arya - A. S.- Design of Steel Structures- Nem Chand and Brothers (2000).
3. Subramanya- N- Design of Steel Structures- N. Subramanian- Oxford University Press(2008).
4. Design of steel structures, A.S.Arya & J.L.Ajmani, Nem chand & Bros., Roorkee.
5. Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
6. Design of steel structures, S.M.A.Kazmi & S.K.Jindal, Prentice Hall, New Delhi.
7. Design of steel structures, S.K.Duggal, TMH Pub., New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	1	-	-	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	1	-	1
CO3	2	2	3	3	1	-	-	-	-	-	-	1	3	3	2
CO4	2	2	3	3	1	-	-	-	-	-	-	1	3	3	2
CO5	2	2	3	3	1	-	-	-	-	-	-	1	3	3	3

Transportation Engineering. -I Lab

Sem -VI

General Course Information

Course Code: PCC-CVE302-P Course Credits: 1 Mode: Practical Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the needs of different tests performed on materials	L2 (Understanding)
CO2	Perform quality control tests on pavements and pavement materials	L3 (Applying)
CO3	Conduct traffic volume and speed studies	L4 (Analyzing
CO4	Evaluate the pavement materials	L5(Evaluating)

*Revised Bloom's Taxonomy

List of Experiment

1. Shape Tests-Flakiness and Elongation Index of aggregates.
2. Aggregate Crushing Value Test

3. Aggregate Impact Value Test
4. Los Angeles Abrasion Value Test
5. Stripping test on aggregates.
6. Determination of bitumen content.
7. Flash and Fire point of bitumen
8. Penetration value of bitumen
9. Softening point of bitumen
10. Ductility of bitumen
11. Marshall's stability test.
12. California Bearing Ratio Test.
13. Traffic volume and Speed study using videography technique.

REFERENCE BOOKS:

1. Khanna S.K. and C.E.G. Justo, Highway Engineering, Nemchand Bros(2012)
2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee (2004).
3. Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (2010)
4. Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi (1999)
5. Yoder E. J.; Principles of Pavement Design, John Wiley & Sons (1975).
6. L.R. Kadiyali, Traffic Engineering and Transportation Planning, Khanna Publishers.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	1	1	-	1
CO2	1	-	-	-	-	-	-	-	-	-	-	1	1	-	1
CO3	1	-	-	-	-	-	-	-	-	-	-	1	1	-	1
CO4	1	2	2	-	-	-	-	-	-	-	-	2	1	-	2

Sewage Treatment Lab
Sem -VI

General Course Information

Course Code: PCC-CVE304-P Course Credits: 1 Mode: PRACTICAL(P) Type: PCC Contact Hours: 2 hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

*Revised Bloom's Taxonomy

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Identify physical, chemical and biological characteristics of sewage	L2(Understanding)
CO2	Solve optimum dosage of coagulant of sewage	L3(Applying)
CO3	Analyze a sewage treatment plant	L4(Analyzing)
CO4	Evaluate break - point chlorination	L5(Evaluating)
CO5	Formulate the quality of Sewage	L6(creating)

Detailed Syllabus:

1. Determination of pH.

2. Determination of Conductivity.

3. Determination of Acidity of sewage

4. Determination of Alkalinity of sewage

5. Determination of Chlorides in sewage

6. Determination of Hardness of sewage

7. Determination of Fluorides in sewage

8. Determination of Available Chlorine in bleaching powder.

9. Conducting Break Point Chlorination Test.

10. Determination of Residual Chlorine.

11. Determination of Dissolved Oxygen.

12. Determination of Chemical Oxygen Demand of sewage

13. Determination of Biochemical Oxygen Demand of sewage

14. Conducting Jar test for determining optimum dosage of coagulant.

15. Determination of Total Solids, Total Dissolved Solids & Settleable Solids.

REFERENCE BOOKS

Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	2	1	1	-	-	-	1	-	-	-
CO2	2	2	1	1	-	2	2	-	-	-	-	2	-	-	-
CO3	2	2	1	1	-	-	1	1	-	-	-	2	1	-	-
CO4	2	3	1	3	-	1	2	-	-	-	-	2	1	-	2
CO5	2	2	3	2	-	2	2	2	1	-	-	2	3	-	2

Soil Mechanics Lab

Sem -VI

General Course Information

Course Code: PCC-CVE306-P Course Credits: 1 Mode: Lecture (P) Type: PCC Contact Hours: 2hours (P) Examination Duration: 03 hours.	***Course Assessment Methods (Internal: 50; External: 50)** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 50 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Classify soils	L2(Understanding)
CO2	Determine index properties of soils	L4(Analyzing)
CO3	Determine engineering properties of soils	L5(Evaluating)

Detailed Syllabus:

1. Specific Gravity of soil particles.
2. Sieve Analysis.
3. Liquid Limit, Plastic Limit & Shrinkage Limit.
4. Proctor's Standard Compaction Test.
5. Determination of Field Density.

6. Constant Head Permeameter Test.

7. Variable Head Permeameter Test.

8. Unconfined Compression Test.

9. Triaxial Compression Test (U.U Test).

10. Consolidation Test.

REFERENCE BOOKS:

1.Soil Mechanics Laboratory Manual.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	-	-	-	-	2	2	-	-
CO2	1	2	-	-	-	-	1	1	-	-	-	2	2	-	2
CO3	1	2	-	-	-	-	1	-	-	-	-	2	2	-	2

Green Building and their Techniques

Sem-VII

General Course Information:

Course Code: PCC-CVE401-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Describe the importance and necessity of green building.	L2 (Understanding)
CO2	Assess a building on the norms available for green building.	L3 (Applying)
CO3	Suggest materials and technologies to improve energy efficiency of building.	L4 (Analyzing)

Unit-I

Introduction of green building, Concept of green building, History of green building, Need of green building in present scenario, Importance of green building Merits and demerits, Classification of green building, site selection for buildings, orientation of buildings, Assessment methods Global assessment and certification, Local assessment, LEED India GRIHA (Green Rating for Integrated Habitat Assessment)

Unit-II

Principles and elements of design of green building;

1. Sustainability: concept and reality

2. Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, ground character, plan form, orientation, roof form.

Unit-III

Water conservation: 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials Concept of carbon emission and its reduction.

Unit-IV

Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings, Introduction to Energy efficiency softwares, carbon calculators

Text Books :

1. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana, Simos Yannas, Nick Baker, S V Szokolay, McGraw hill Education, Seventh reprint, 2013

2. Tom Woolley, Sam Kimmins,Paul Harrison and Rob Harrison, Green Building, Handbook,Volume I, Spon Press, 2003

3. Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984

Reference Books : Standards / Guidelines

1. Handbook on functional requirements of buildings (SP41), BIS, New Delhi, 1987

2. Energy Conservation building code (ECBC), Bureau of energy efficiency, 2011

3. Green Rating for Integrated Habitat Assessment (GRIHA) guidelines.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	1	-	1	1	1	-	-	-	1	1	-	1
CO2	2	-	1	1	-	-	1	-	-	-	-	-	1	-	1
CO3	2	-	1	1	2	1	1	1	-	-	-	2	2	-	1

Transportation Engineering -II

Sem -VII

General Course Information:

Course Code: PCC-CVE403-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Recall various equipments used in road construction	**L1 (Remembering)**
CO2	Understand the equipments used in road construction	**L2(Understanding)**
CO3	Select the specifications for construction and maintenance of pavement layers.	**L3(Applying)**
CO5	Examine the quality of pavement layers during construction and maintenance.	**L4(Analyzing)**
CO5	Construct and maintain the pavements.	**L5(Evaluating)**

Course Content

UNIT-I

Plants and Equipments: Components of pavement structure, functions and requirements, Plants and Equipments: Excavators, graders, compactors, crushers, bituminous hot mix plants, cement concrete mixers, pavers - uses in road construction.

UNIT II

Bituminous binders and mixes – different types, properties and uses, physical tests on bitumen, Rheological and pavement performance related properties, Modified binders, requirements of ideal pavement binders, characteristics and applications in road construction, criteria for selection of different binders.

Bituminous mixes, types, requirements, properties, tests, Marshall Method of mix design, Additives & Modifiers in Bituminous mixes, problems on mix design.

UNIT III

Construction of Subgrade and Subbase: Specifications and steps for construction of subgrade, subbase
Construction of granular layers: Specifications and steps of construction, WBM, WMM
Construction of Bituminous Layers: Different types of bituminous layers, specifications and construction of bituminous layers

Construction of Cement Concrete Pavements: Specifications and steps for construction of DLC, Paving Quality Concrete pavements, quality control tests

Safety during Construction: Safety aspects during construction and maintenance works

UNIT IV

Drainage: Assessment of drainage requirements for the road, design of various drainage components, drainage materials, surface and sub-surface drainage system for roads, drainage of urban roads

Maintenance: Routine and periodic maintenance, preventive and reactive maintenance for drainage and pavements, Preparation of existing pavement for patching, profile correction, special measures to deal with reflection cracks in pavement overlays, requirements for rehabilitation, recycling

REFERENCE BOOKS:

1. Khanna S.K. and C.E.G. Justo, Highway Engineering, Nemchand Bros(2012)
2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee (2004).3.
3. "Specifications for Road and Bridge works", MoRTH, fifth revision, 2013, Indian roads Congress, New Delhi
4. IRC :15-2011, IRC :14-2004, IRC :35-2015, IRC:67-2012, IRC:109-2015, IRC:111-2009, IRC:120 2015, IRC:SP:11-1984, IRC:SP:42-2014, IRC:SP:50-2013

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	1	1	1	-	-	-	-	-	1	-	1	1	1	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	1	2	-	1
CO4	2	1	2	1	-	-	-	-	-	-	2	1	1	-	1
CO5	1	1	2	2	-	-	-	-	1	-	2	1	1	-	1

Design of Steel Structures-II
Sem VII

General Course Information

Course Code: PCC-CVE405-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	At the end of the course students will be able to:	RBT* Level
CO1	Understand the concept and design of plastic and steel structures	L1(Remembering)
CO2	Understand the concept on transmission towers	L3(Understanding)
CO3	Analyze and design the various tubular steel structures	L4 (Analyzing)
CO4	Develop Conceptual knowledge about cold form sections.	L5 (Evaluating)
CO5	Design the plastic and steel structures	L6 (Creating)

***Revised Blooms Taxonomy

UNIT-I

Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, shape factor, mechanisms, plastic collapse, plastic analysis of beams and portal frames, design of beams.

UNIT-II

Design of Steel Stacks: Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation.

Cold formed Sections: Introduction and brief description of various types of cold formed sections.

UNIT-III

Design of round tubular structures - Introduction, sectional properties, permissible stresses, grades of steel tubes, tubular tension members, tubular compression members, tubular flexural members, combined bending and axial stresses.

Towers: Basic introduction to transmission and telecommunication towers.

UNIT-IV

Design of steel tanks - Design loads, permissible stresses, design of cylindrical tanks with suspended bottom, supporting ring beam, staging for tanks, rectangular pressed steel tanks.

Text Books

1 Design of Steel Structures, A.S. Arya and J.L. Ajmani, Nem Chand Brothers, Roorkee

2 Design of Steel Structures, Ram Chandra, Vol. I & II, Standard Book House

3 Design of Steel Structures, P. Dayaratnam, Wheeler Publishing, New Delhi.

4 Design of Steel Structures, S.K.Duggal, TMH Pub., New Delhi.

5 Bhavikatti, S.S., Design of Steel Structures, I.K. International Publishing House Pvt. Ltd., New Delhi

Reference Books

1 BIS Codes IS 800:2007, IS 801:1975, IS 875

2 Design of Steel Structures, B.C. Punmia, Laxmi Publication, Delhi

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	-	-	-	1	1	1	1
CO2	2	2	2	1	1	-	-	-	-	-	-	1	1	1	1
CO3	2	2	2	1	1	-	-	-	-	-	-	1	1	1	2
CO4	2	2	2	2	1	-	-	-	-	-	-	1	2	2	3
CO5	2	2	2	2	1	-	-	-	-	-	-	1	2	2	3

Software Lab-II

Sem-VII

General Course Information:

Course Code: PCC-CVE407-P Course Credits: 0 Mode: Practical (P) Type: PCC Contact Hours: 2 hours (P)	**Course Assessment Methods (Internal: 50)** The internal assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, and ethical practices followed. There will be a continuous process for laboratory course evaluation and will be done by the internal examiner

S. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand the basic components of flexible pavements	L2(Understanding)
CO2	Scheduling, resource allocation and Controlling of projects	L3(Applying)
CO3	Design Flexible Pavement using MX ROAD software	L6 (Creating)

Introduction to Civil Engineering Softwares like MX ROAD, and Primavera.

Students will be able to do:

1. Design of flexible Pavement using MX-Road
2. Plan a project using Primavera

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	1	-	-	-	-	-	-	-	1	1	1	-
CO2	1	2	2	2	3	-	-	-	-	-	-	1	3	3	-
CO3	2	2	3	2	3	-	-	-	-	-	-	2	3	3	-

Construction Costing and Management
Sem -VIII

General Course Information

Course Code: PCC-CVE402-T Course Credits: 3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand basic planning for a construction project.	L2 (Understanding)
CO2	Prepare specifications for different items of Civil Works	L3 (Applying)
CO3	Analyze rates for various items of works	L4 (Analyzing)
CO4	Estimate quantities of different items of Civil Engineering Works	L5 (Evaluating)
CO5	Perform quality assurance and control.	L6 (Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Basics of Construction- Unique features of construction, construction projects types and features, phases of a project, **Construction project planning-** Stages of project planning, Process of development of plans and schedules, work break-down structure, Techniques of planning- Bar charts, Gantt Charts.

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing.

UNIT-II

Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

UNIT-III

Estimate: Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two roomed building with different sections of walls, foundation, floors and roofs, R.C.C. works, Plastering, White-washing, Distempering and painting, doors and windows, lump sum items.

UNIT-IV

Specification of Works: Necessity of specifications, types of specifications, general specifications, specification for bricks, cement, sand, water, lime, reinforcement; Detailed specifications for Earthwork, Cement, concrete, brick work, floorings, D.P.C., R.C.C., cement plastering.

Rate Analysis: Purpose, importance and requirements of rate analysis, units of measurement, preparation of rate analysis, procedure of rate analysis for items: - Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing (white-washing, distempering).

REFERENCE BOOKS

1. *National Building Code*, Bureau of Indian Standards, New Delhi, 2017.
2. Chudley, R., *Construction Technology*, ELBS Publishers
3. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill
4. Estimating & Costing in Civil Engg..: Theory & Practice by B.N.Dutta, S.Dutta & Co., Lucknow.
5. Estimating, Costing & Specification in Civil Engg. by M.Chakarborty, Calcutta

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	1	1	1	-	2	2	-	-	2
CO2	2	2	1	1	-	-	-	-	-	1	2	2	1	-	2
CO3	2	2	1	1	-	-	-	1	1	1	3	2	1	-	2
CO4	2	2	1	1	-	1	1	1	1	-	3	2	1	1	2
CO5	-	-	-	-	-	2	2	2	1	3	3	3	-	-	3

Transportation Engineering -III
Sem -VIII

General Course Information

Course Code: PCC-CVE404-T Course Credits:3 Mode: Lecture (L) Type: PCC Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the permanent way and coning of wheels	L2 (Understanding)
CO2	Employ Railway Track specifications and perform geometric design of the railway track.	L3(Applying)
CO3	Analyze Suitability and limitation of different types of tunnels	L4(Analyzing)
CO4	Design turnout and crossings as per the Indian Railways	L5 (Evaluating)

Course Contents

UNIT-I

Introduction: Role of railways in transportation, historical development of railways.

Railway Engineering: Permanent way, gauges in railway tracks, typical railway track cross-section, coning of wheels, Function of rails, requirement of rails, types of rail sections – comparison of rail types, length of rail, rail wear, rail failures, creep of rails, rail fixtures and fastenings – Fish plates, spikes, bolts, chairs, keys, bearing plates.

UNIT-II

Sleepers: Functions and requirements of sleepers, classification of sleepers, timber, metal and concrete sleeper, comparison of different types of sleepers, spacing of sleepers and sleeper density.

Ballast: Function and requirements of ballast, types, comparison of ballast materials.

Geometric design: alignment, horizontal curves, super elevation, equilibrium, cant and cant deficiency, length of transition curve, gradients and grade compensation. Stations and yards, and their classification

UNIT-III

Points and crossings: introduction, necessity of points and crossings, turnouts, points and crossings, design of a simple turnout.

Track Recording: Equipment, Mechanized Maintenance, High Speed Trans, Present & Future.

Signaling and interlocking: objects of signaling, engineering principle of signaling, classification of signaling, control of train movements, interlocking definition, necessity and function of interlocking, methods of interlocking, mechanical devices for inter locking. Traction and tractive resistance, stresses in track, modernization of railway track.

UNIT-IV

Tunnels: Necessity/advantage of a tunnel, Classification of Tunnels, Size and shape of a tunnel, Alignment of a Tunnel, Sections of tunnels—advantages, limitations and suitability, shafts, pilot tunnels, methods of driving tunnels in rocks and soft grounds, Mucking, Lighting and Ventilation in tunnel.

REFERENCE BOOKS

1. Rangawala, Railway Engineering, Charotar Publishing House, Anan (1989).
2. Aggarwal M.M., and Satish Chandra Railway Engineering, Oxford University Press (2002).
3. Arora and Saxena, Railway Engineering, Dhanpat Rai & Sons, New Delhi (2006).
4. S.C. Saxena, Tunnel Engineering, Dhanpat Rai & Sons, New Delhi

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	1	-	-	-	-	-	1	1	-	-
CO2	1	1	3	-	2	-	-	-	-	-	1	1	1	2	3
CO3	1	1	2	2	-	-	-	-	-	-	1	1	3	1	2
CO4	1	-	3	3	2	1	-	-	-	-	2	1	1	3	2

GF-CVE406-P: GENERAL FITNESS FOR THE PROFESSION

Sem VIII

L	T	P	Credits			
0	**0**	**0**	**0**	**Total**	**:**	**50 Marks**

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

The evaluation will be made by the committee of examiners constituted as under:

University Departments:

1. Chairperson of the Department — Chairman
2. Faculties of the Department — Members

Affiliated Colleges:

1. Director/Principal — Chairman
2. Head of the Department/Sr. Faculty — Member
3. External Examiner to be appointed by the University — Member

4. The student will present a written report before the committee with following in view:

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

I. Academic Performance (05 Marks)

II. Extra-Curricular Activities (10 Marks)

III. Educational tours/visits/Membership of Professional Societies (05 Marks)

IV. Sports/Games (05 Marks)

Note: Report submitted by the students should be typed on both sides of the paper.

5. A student will support his/her achievement and verbal & communicative skill through presentation before the examiners. (10 Marks)

6. Faculty Counselor Assignment (15 Marks)

It will be the duty of the student to get evaluated by respective faculty counselor and to submit the counselor assessment marks in a sealed envelope to the committee.

A counselor will assess the student which reflects his/her learning graph including followings:

- Discipline throughout the year
- Sincerity towards study
- How quickly the student assimilates professional value system etc.

A specimen Performa indicating the weightage to each component/ activity is given below :-

Name : _____College Roll No._____

University Roll No. _____

Branch_____Year of Admission _____

I. Academic Performance (05 Marks) :

(a) Performance in University Examination :-

Semester	Result	%age of marks obtained	No. of attempts in which the Sem. exam. has been cleared
I			
II			
III			
IV			
V			
VI			
VII			

II. Extra-Curricular Activities (10 Marks) :

Essay	
Competition	
Scientific Technical Exhibitions	
Debate	
Drama	
Dance	
Music	
Fine Arts	
Painting	
Hobby Club	
N.S.S.	
Hostel Mgt Activities	
Any other activity (Please Specify)	

III. Educational tours/visits/Membership of Professional Societies (05 Marks)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

IV. Sports/Games (05 Marks)

Item	**Level of Participation**	**Remarks (Position Obtained)**
Indoor Games (Specify the Games	_____	_____
	_____	_____
	_____	
Outdoor Games (Specify the Games)	_____	
	_____	
	_____	

V. Performance in Viva voice before the committee (10 Marks)

_____
_____
_____

VI. Faculty Counselor Assignment (15 Marks)

*Marks obtained I. ( ) + II ( ) + III ( ) + IV ( ) + V ( ) + VI ( ) =

**Total Marks :

Member Member Chairman

Professional Elective Course-I	
1. Air & Noise Pollution Control	PEC-CVE350-T
2.Solid and Hazardous Waste Management	PEC-CVE351-T
3. Environmental Impact Assessment and Life Cycle Analyses	PEC-CVE352-T
4. Water and Air Quality Modelling	PEC-CVE353-T
5. Disaster Preparedness & Planning	PEC-CVE354-T
Professional Elective Course-II	
1. Pavement Design	PEC-CVE450-T
2. Geometric Design of Highways	PEC-CVE451-T
3. Traffic Engineering & Management	PEC-CVE452-T
4. Introduction to Road Safety Audit	PEC-CVE463-T
5. Airport Planning and Design of Airfield Pavements	PEC-CVE464-T
Professional Elective Course-III	
1. Construction Management	PEC-CVE453-T
2. Advanced Construction Materials	PEC-CVE454-T
3. Advanced Construction Techniques	PEC-CVE455-T
Professional Elective Course-IV	
1. Foundation Engineering	PEC-CVE456-T
2. Ground Improvement	PEC-CVE457-T
3. Geotechnical Design	PEC-CVE458-T
Professional Elective Course-V	
1. Irrigation & Design of Hydraulic Structures	PEC-CVE460-T
2. Open Channel Flow	PEC-CVE461-T
3. Groundwater Engineering	PEC-CVE462-T

Air & Noise Pollution Control

Sem VI

General Course Information:

Course Code: PEC-CVE350-T Course Credits: 3 Mode: Lecture (L) Type: PEC-I Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand sources of air pollution, air pollution problems	**L1(Remembering)**
CO2	Demonstrate a detailed knowledge of study the effect of meteorological parameters in the dispersion of air pollutants	**L3(Applying))**
CO3	Analyze Environment legislation and regulations for air and noise pollution	**L4(Analyzing)**
CO4	Evaluate efficiency of various air pollution control devices used for particulate removal	**L5(Evaluating)**
CO5	Design, operate and control the devices used for gaseous emission control and noise emission control	**L6(Creating)**

Course Contents

UNIT-I

Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects, Smoke, smog and ozone layer disturbance, Greenhouse effect.

UNIT-II

Air sampling and pollution measurement methods, principles and instruments, ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations

UNIT-III

Control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and

other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.

UNIT-IV

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods

REFERENCE BOOKS

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2000.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt. Ltd, New Delhi, 1993.
3. G.K. Nagi, M.K. Dhillon, G.S. Dhaliwal, Commonwealth Publishers, Noise Pollution.
4. S.K. Garg, Khanna publishers, Sewage Disposal and Air Pollution Engineering.
5. S.M. Khopkar, Environmental pollution analysis, New Age International Publications

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	1	-	-	-	1	1	-	-
CO2	1	2	3	-	-	1	2	1	-	-	1	1	1	2	3
CO3	1	3	-	-	-	1	2	1		1	1	2	3	-	1
CO4	-	2	3	2	-	1	2	-	-	-	2	2	1		3
CO5	-	2	3	1	-	1	2	-	2	-	2	3	1	3	2

Solid and Hazardous Waste Management

Sem VI

General Course Information:

Course Code: PEC-CVE351-T Course Credits: 3 Mode: Lecture (L) Type: PEC-I Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Describe the principles of solid & hazardous waste management.	**L1(Remembering)**
CO2	Acquire knowledge on specialized solid & hazardous waste treatment	**L2(Understanding)**
CO3	Illustrate various techniques for treatment of solid waste and hazardous waste	**L3(Applying)**
CO4	Analyze policies regarding solid and hazardous wastes including legal implications.	**L4(Analyzing)**
CO5	Design & optimize techniques in solid & hazardous waste management	**L6(Creating)**

Course Contents

UNIT-I

Solid Wastes: Origin- Analysis- Composition and Characteristics. Integrated Solid Waste Management System: Collection- Storage- Segregation- Reuse and Recycling possibilities- Transportation- Treatment / Processing and Transformation Techniques- Final Disposal.

UNIT-II

Management of: Municipal- Biomedical- Nuclear- Electronic and Industrial Solid Wastes and the rules and regulations.

UNIT-III

Introduction to Hazardous wastes- Definition of Hazardous waste- The magnitude of the problem; Hazardous waste: Risk assessment- Environmental legislation- Characterization and site assessment- Waste minimization and resource recovery- Transportation of hazardous waste- Physical- chemical and biological treatment- Ground water contamination- Landfill disposal

UNIT-IV

Current Management Practices- Environmental audit- Pollution Prevention- Facility Development and operation- Site Remediation: Quantitative risk assessment- site and subsurface characterization- Containment- remedial alternatives.

REFERENCE BOOKS

1. Solid and Hazardous Waste Management , M.N. Rao and Razia Sultana
2. Environmental Hazards-Smith- Keith
3. Environmental Hazards-Iqbal- M-Srivastava- A.S. and Siddiqu- T.Q.
4. Basic Environmental Technology-Nathanson- J.A.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	1	-	-	-	2	1	-	-
CO2	2	1	-	1	-	1	1	2	-	1	1	2	1	-	2
CO3	1	3	3	2	1	1	2	1	1	-	2	2	1	2	2
CO4	1	2	2	1	--	1	1	2	-	1	2	2	3	1	1
CO5	1	1	3	3	3	1	1	1	1	-	2	2	1	3	2

Environmental Impact Assessment and Life Cycle Analysis

Sem VI

General Course Information:

Course Code: PEC-CVE352-T Course Credits: 3 Mode: Lecture (L) Type: PEC-I Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Be aware of the environmental legislations- policies of the country and of international environmental conventions and protocols	L1(Remembering)
CO2	Identify the environmental attributes to be considered for the EIA study	L2(Understanding)
CO3	Illustrate objectives of the EIA studies	L3(Applying)
CO4	Evaluate the methodology to prepare rapid EIA	L5(Evaluating)
CO5	Formulate the methodology Environmental Auditing	L6(Creating)

Course Contents

UNIT-I

Basic Concepts of Environmental Impact Assessment: Description of the project and the environmental setting- identification of impacts- measurement and monitoring- prediction and assessment of impacts and communication of impacts.

UNIT-II

Environmental Impact Assessment Methodologies: Checklists- matrices- networks and overlays Prediction and Assessment of Impact on the physical environment- on the resources- and on the socio-economic- Environmental cost benefit analysis Sustainable development. Life Cycle Assessment -Environmental Risk Analysis- Definition of Risk

UNIT-III

Environmental auditing: Definition and types of audits- EMS audits- performance audits; compliance audits- registration audits ISO 14000 series of standards and environmental auditing- Methodologies for Environmental Auditing: Objectives- audit teams- planning audits- conducting audits- reporting audit findings

UNIT-IV

EIA related to the following sectors - Infrastructure –construction and housing Mining – Industrial - Thermal Power - River valley and Hydroelectric Acts: Water act- Water Cess act- Air act- Environment Protection act and their amendments- Wildlife act and Forest acts. Case Studies on EIA

REFERENCE BOOKS

1. Environmental Impact Analysis by R.K. Jail and L.V. Urban.
2. Environmental Impact Assessment by Canter.
3. Environmental Impact Assessment by J. Glasson

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	1	1	-	1	2	1	1	-	-
CO2	-	2	-	-	-	2	1	1	-	-	2	1	1	2	1
CO3	1	2	-	-	-	1	1	-	-	-		1	1	-	1
CO4	1	2	1	2	--	-	-	-	1	--	2	1	1	2	1
CO5	1	2	1	2	-	-	-	-	1	-	2	1	1	2	1

Water and Air Quality Modeling

Sem VI

General Course Information:

Course Code: PEC-CVE353-T Course Credits: 3 Mode: Lecture (L) Type: PEC-I Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Define different mathematical models for air and water quality	**L1(Remembering)**
CO2	Recognize the risks of disposal of treated wastewater into the river	**L2(Understanding)**
CO3	Predict the quality of water and air through modeling	**L4(Analzing)**
CO4	Evaluate the physical- chemical and biological water quality which is essential for the abatement of water pollution	**L5(Evaluating)**
CO5	Design sound and sustainable water and air models under specified conditions	**L6(Creating)**

Course Contents

UNIT-I

Water and air quality management- Introduction to Mathematical Models: kinds of mathematical models – model development- Model requirements and limitations- validation effluent and stream standards; ambient air quality standards.

UNIT-II

Water quality model development- D.O. Models for Streams: Dissolved oxygen model for streams sources and sinks of dissolved oxygen estimation of system parameters Streeter Phelps model - oxygen 'sag' curve-determination of deoxygenation and re-aeration coefficients- Benthal oxygen demand mass transport mechanisms

UNIT-III

Models for Estuary and Lakes: Assumptions- Benefits- Limitations- Physical- chemical and biological processes in estuaries and lakes;

Mass transport of solutes- degradation of organic compounds- application of concepts to predict groundwater contaminant movement- seawater intrusion – basic concepts and modeling

UNIT-IV

Air quality models: Micrometeorological processes- wind rose- dispersion- coefficients and stability classes- Gaussian and dispersion model- Stack height computation- Regional air quality models- Source inventories and significance. Air pollution modeling and prediction – Plume rise modeling techniques- modeling for non-reactive pollutants- single source – short term impact- multiple sources and area sources- model performance and utilisation- computer models.

REFERENCES BOOKS

1. Environmental Engineering Peavy- Rowe and Tchobanglous- McGraw Hill.
2. Water and Waste Water Engineering (Vol. 1&2)- Fair- Geyer &Okun- John Wiley- New York.
3. Water Supply Engineering P.N. Modi- Standard Book House New-Delhi.
4. Standard Methods for the Examination of Water and Waste Water- American Public Health Association.
5. Environmental Engg.: by Howard s. Peavy& Others- MGH International.
6. Metacaf – EDDY – Waste-water engineering revised by George Teholonobus (TMH)
7. Manual on Water Supply and Treatment by Ministry of Urban Development- New Delhi.
8. Water Supply and Sewerage- McGhee- McGraw Hill.
9. Environmental Engineering- Vol. I- S.K. Garg- Khanna Publishers- New-Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	1	-	-	-	-	-	-	1	1	-	-
CO2	1	2	-	-	-	2	2	2	-	-	-	1	1	-	2
CO3	-	3	-	1	2	1	3	1	-	-	2	1	3	-	1
CO4	1	3	1	2	-	1	-	-	2	1	2	2	3	1	2
CO5	1	1	3	2	2	1	1	-	1	-	1	1	1	3	2

Disaster Preparedness & Planning

Sem-VI

General Course Information:

Course Code: PEC-CVE354-T Course Credits: 3 Mode: Lecture (L) Type: PEC-I Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Ability to understand Categories of Disasters	L2(Understanding)
CO2	Realization of the responsibilities to society	L3(Applying)
CO3	Analyzing Relationship between Development and Disasters	L4(Analyzing)
CO4	The application of Disaster Concepts to Management	L5(Creating)

Course Contents

UNIT-I

Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks - severity, frequency and details, capacity, impact, prevention, mitigation).

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); man-made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT-II

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-III

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response(water, sanitation, food safety, waste management, disease control,

security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

UNIT-IV

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods.

REFERENCE BOOKS

1. http://ndma.gov.in/ (Homepage of National Disaster Management Authority)
2. Pradeep Shani, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
3. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
4. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
5. . Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California,EMSA no.214, June 2003

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	-	-	-	-	1	-	-	-	1	2	1	-
CO2	-	-	-	-	-	3	-	2	-	-	-	1	1	-	2
CO3	-	-	-	1	-	3	3	2	2	-	-	1	2	-	
CO4	-	-	-	-	-	-	-	-	-	1	3	2	1	2	3

Pavement Design

Sem VII

General Course Information

Course Code: PEC-CVE450-T Course Credits: 3 Mode: Lecture (L) Type: PEC-II Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course Outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Identify the stresses, deflections and designs of flexible and rigid pavements	L2(Understanding)
CO2	Calculate stresses and ESWL in flexible and rigid pavements	L3(Applying)
CO3	Analyze the warping, friction, wheel load stress and calculate the combined stress	L4 (Analyzing)
CO4	Evaluate method for designing of various types of pavements	L5 (Evaluating
CO5	Design the flexible and rigid pavements using various methods	L6 (Creating)

Course Contents

UNIT-I

Stresses and Deflections in Flexible Pavements: Stresses and deflections in homogeneous masses. Burmister's two layer theory, three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels. Repeated loads and EWL factors; sustained loads. Pavement behavior under transient traffic loads

UNIT-II

Flexible Pavement Design Methods for Highways and Airports: Empirical, semi-empirical and theoretical approaches, development, principle, design steps, advantages; design of flexible pavements as per IRC

UNIT-III

Stresses in Rigid Pavements: Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses

UNIT-IV

Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacings; design of CC pavement for roads and runways as per IRC, design of joint details for longitudinal joints, contraction joints and

expansion joints. IRC method of design by stress ratio method. Design of continuously reinforced concrete pavements; Maintenance, repair and rehabilitation of pavements including design of bituminous and concrete overlays as per IRC.

REFERENCE BOOKS

1. Principles and Practice of Highway Engineering, L.R.Kadiyali, Khanna Publications
2. Highway engineering, Khanna S.K. & Justo C.E.G. Nem Chand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	1	-	-	-	-	-	1	2	1	1	2
CO2	1	1	2	1	1	-	-	-	-	-	1	2	1	2	3
CO3	2	3	3	2	1	-	-	-	-	-	1	2	3	3	3
CO4	2	3	3	3	1	-	-	-	-	-	1	2	3	3	3
CO5	2	2	3	3	1	-	-	-	-	-	1	2	3	3	3

Geometric Design of Highways

Sem VII

General Course Information

Course Code: PEC-CVE451-T Course Credits: 3 Mode: Lecture (L) Type: PEC-II Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Describe various aspects of the geometric designs of different types of roads and highways	L2(Understanding)
CO2	Draw Horizontal and Vertical Alignment of different kinds of roads.	L3(Applying)
CO3	Analyze design controls and elements of roads and highways.	L4 (Analyzing)
CO4	Evaluate design consideration of highways	L5 (Evaluating)
CO5	Design highways and expressways using IRC standards and guidelines.	L6 (Creating)

Course Contents

UNIT-I

Introduction: Classification of rural highways and urban roads, Objectives and requirements of highway geometric design;

Design Controls: Topography, vehicle characteristics and design vehicle, driver characteristics, speed, traffic flow and capacity, levels of service, pedestrian and other facilities, environmental factors; Design Elements: Sight distances

UNIT-II

Horizontal alignment - design considerations, stability at curves, super elevation, widening, transition curves; curvature at intersections

Vertical alignment - grades, ramps, design of summit and valley curves, combination of vertical and horizontal alignment including design of hair pin bends

UNIT-III

Design of expressways, IRC standards and guidelines for design problems; Cross Section Elements: Right of way and width considerations, roadway, shoulders, kerbs traffic barriers, medians, frontage roads; Facilities for pedestrians, bicycles, buses and trucks, Pavement surface characteristics - types, cross slope, skid resistance, unevenness;

UNIT-IV

Design Considerations: Design considerations for rural and urban arterials, freeways, and other rural and urban roads; Design of Intersections: Characteristics and design considerations of at-grade intersections; Rotary intersections; Grade separations and interchanges - Design of Parking lots

Books

1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna Publications
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications
3. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	1	-	-	-	-	-	1	1	1	2	2
CO2	2	2	2	2	1	-	-	-	-	-	1	2	2	2	2
CO3	1	2	2	2	1	-	-	-	-	-	1	2	3	3	3
CO4	1	2	3	3	1	-	-	-	-	-	1	2	3	3	3
CO5	2	2	3	3	1	-	-	-	-	-	1	2	3	3	3

Traffic Engineering & Management

Sem VII

General Course Information

Course Code: PEC-CVE452-T Course Credits: 3 Mode: Lecture (L) Type: PEC-II Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Explain general principles of traffic engineering and management.	L2 (Understanding)
CO2	Apply traffic safety and traffic pollution measures for public good	L3 (Applying)
CO3	Analyze traffic problems and plan for traffic system's various uses	L4 (Analyzing)
CO4	Evaluate traffic and parking problems through traffic surveys	L5 (Evaluating)
CO5	Design Channels, Intersections, signals and parking arrangements	L6 (Creating)

Course Content

UNIT-I

Traffic Planning and Characteristics: Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.

UNIT-II

Traffic Surveys: Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

UNIT-III

Traffic Design and Visual Aids: Intersection Design – channelization, Rotary intersection design – Signal design – Coordination of signals –– Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Networking pedestrian facilities & cycle tracks.

UNIT-IV

Traffic Safety and Environment: Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

Traffic Management: Area Traffic Management System – Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education

REFERENCE BOOKS:

1. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
2. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
3. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013
4. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	-	1	1	-	-	-	1	2	1	1	2
CO2	1	1	2	1	-	1	1	-	-	-	1	2	1	2	3
CO3	2	3	3	2	-	2	2	-	-	-	1	2	3	3	3
CO4	2	3	3	3	-	2	2	-	-	-	1	2	3	3	3
CO5	2	2	3	3	-	2	2	-	-	-	1	2	3	3	3

Introduction to Road Safety Audit

Sem VII

General Course Information

Course Code: PEC-CVE463-T Course Credits: 3 Mode: Lecture (L) Type: PEC-II Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Know about road safety scenario in India and the need of planning and design for safety	L2 (Understanding)
CO2	Generate awareness about number of people dyeing every year in road accidents, traffic rules and characteristics of accident.	L3 (Applying)
CO3	Understand the concepts of various stages of road safety audit and methods of prioritization of audit recommendations.	L4 (Analyzing)
CO4	Acquire a certificate of coordination/ participation in compulsory events based on the topic under study	L5 (Evaluating)

Course Content

UNIT- I

Introduction to Road Safety: Road traffic accidents scenario in India and in world. Road Safety and its importance. Traffic Rules and Driving Behavior. Characteristics of road crashes, accidents vs. crash, Black spot identification, safety performance functions and accident modification factors.

UNIT – II

Road Safety Auditing- An Introduction, How to Conduct Road Safety Audit, Design Stage Road Safety Audit, Road Safety Audits of Land Use Developments, Traffic Control Devices & Safety, Needs of Different Road Users, Road Safety Audit in Road Works & Pre-Opening Safety Audit.

Street Lighting & Traffic Signals, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

UNIT – III

Safe System Approach- A Global Perspective, Speed Management & safety, Safe System and Speed & Assessing speed limit, Type of speed limit & Speed zone signing Infrastructure to support safe speed feedback and enforcement.

Hazard Management Organizational commitment & encouraging RSA, Road Safety Audit Checklist.

UNIT – IV

Site Visits and Preparation of the Audit Reports.

Risk Assessment & Prioritization of audit recommendations, Solutions and effectiveness & Corrective, Action Report.

Text Books

1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Highway Engineering by L.R. Kadyali, Nem Chand & Brothers, Roorkee

Reference Books

1. Highway Engineering by Oglesby and Hews
2. Transportation Engineering by G.V. Rao, Tata McGraw Hill Publisher, New Delhi
3. Traffic Engineering by Matson,Smith&Hurd
4. Road safety audit Manual
5. Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996
6. Indian Roads Congress, Road Safety Audit Manual, IRC: SP-88-2019.

*Celebration of Road Safety week or Workshop on Road Safety week/ Organization of seminar on Road Safety

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	2	2	-	1
CO2	2	1	1	-	-	1	1	1	1	-	-	-	2	-	2
CO3	2	2	2	1	-	1	-	-	-	-	-	1	2	-	3
CO4	-	-	-	-	-	2	2	-	-	2	2	2	2	-	3

Airport Planning and Design of Airfield Pavements

Sem VII

General Course Information

Course Code: PEC-CVE464-T Course Credits: 3 Mode: Lecture (L) Type: PEC-II Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the characteristics of an Aircraft	L2 (Understanding)
CO2	Prepare layout for airport, runway, taxiway and apron.	L3 (Applying)
CO3	Design geometrics of various airport components.	L4 (Analyzing)
CO5	Design of airfield pavements.	L6 (Creating)

Course Content

UNIT I

Airport Engineering: Brief history of air transport: Aircraft characteristics. Airport site selection, various surveys for site selection. Classifications of obstructions, Imaginary surfaces, Approach zone and turning zone. Runway orientation, basic runway length, corrections for elevation, temperature & gradient, airport classifications.

UNIT II

Airport Design: runway geometric design, airport capacity, factors controlling taxiway layout, geometric design standards for taxiway holding aprons. Terminal area, building area, parking area, apron, hanger typical airport layouts. LCN/PCN method of rigid pavement design. Trend growth of Domestic Air Traffic in India, Air Cargo.

UNIT III

Air traffic control aids: visual aids, marking and lighting of runway and apron area, wind and landing direction indicator

UNIT IV

Design of flexible and rigid runways: Factors affecting design and performance of airport pavements. Design procedure, Specifications for the different layers of runway and taxiway pavements, Pavement management systems for runway pavements.

Reference Books

1. Airport Engineering by Harnjeff, McGraw Hill Inter. Publisher
2. Khanna, Arora & Jain, Airport Planning and Design, Nem Chand &brothers

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	2	-	-	-	-	-	-	-	1	2	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	1	2	-	2
CO3	2	2	2	-	-	-	-	-	-	2	-	1	2	-	3
CO4	2	2	2	-	-	-	-	-	-	2	-	2	2	-	3

Construction Management

Sem VII

General Course Information

Course Code: PEC-CVE453-T Course Credits: 3 Mode: Lecture (L) Type: PEC-III Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand and Apply various material & equipment management techniques in a project	L2(Understanding)
CO2	Illustrate the project planning, scheduling, time-cost optimization, resource allocation and project controlling	L3(Applying)
CO3	Analyze the rate analysis for the various construction activities	L4(Analyzing)
CO4	Estimate the cost for the building and the road projects	L5 (Evaluating
CO5	Prepare the contract documents for a given project &Assemble bill of quantities	L6(Creating)

Course Content

UNIT-I

Quantity Surveying and Cost Estimation: Definitions, objectives, role and functions of quantity surveyor, Pre-tender survey, Quantity measurements, Bill of quantities, analysis of rates for different items of work. Specifications. General and detailed specifications for different items of work. Estimates and budgets types and their preparation. Estimate of Buildings, Roads, Building Bye Laws, Taking-off quantities, Methods of measurement, e-tendering, Bill of quantities.

UNIT-II

Contracts: Definition, need, importance, types of contracts and their characteristics, procedure for tendering and contracts, evaluation and examination of tenders, award of work, Joint Ventures, Concession Agreements. Valuation, its types.Determination of value of a property, Calculation of standard rent. Definitions, functions, characteristics of project, planning and principles of Planning and Management.

UNIT-III

Network Techniques: Bar milestone charts Planning and scheduling of PERT / CPM, Time cost optimization, Probability concepts Allocation of resources and resource levelling, Updating, controlling and monitoring, Work Breakdown Schedule (WBS).

UNIT-IV

Material& Equipment Management: Importance, scope, objectives and functions, identification of source and vendor analysis, purchase, procurement procedure, inventory control, EOQ analysis. Importance, need, functions and principles of equipment management, types of equipment and their uses, selection planning and matching of construction plant and equipment.

Account Procedure of PWD Works: Classification of Works, Muster Roll, and Deposit works. Cash Book, Imprest, temporary Advance, Stores, Indent, Tools and Plants

REFERENCE BOOKS:

1. Seetharaman S., Construction Engineering and Management, Umesh Publication Delhi(2001).
2. Punima B. C. and Khandelwal; Project Planning and Control with PERT and CPM,Laxmi Publication New Delhi(2002).
3. K.K. Chitkara, Construction project management: planning, scheduling and controlling, Tata McGraw-Hill (1998).
4. B. Sengupta and H Guha, "Construction management and planning", Tata McGraw Hill(1995).
5. L.S. Srinath, PERT and CPM principles and Application, Third edition, Affiliated east-west press Pvt Ltd(2001)
6. J. Singh, Heavy Construction-Planning, equipment and method, Oxford & IBH Publishing Co. Pvt(1993)
7. Datta B. N. Estimating and Costing in Civil Engineering, U.B.S. Publisher(2010)
8. Kohli D. D.; A Text book on Estimating and Costing and Accounts, S. Chand & Company New Delhi(1994).
9. R.L. Peurifoy, W.B. Ledbetter and C.J. Schexnayder, "Construction planning and methods", Fifth editions, McGraw Hill International edition(1996).

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	1	1	1	-	1	1	1	-	1
CO2	1	3	2	-	1	-	2	1	2	-	3	1	1	2	2
CO3	1	3	1	-	-	1	-	-	-	1	1	1	3	-	2
CO4	1	2	-	2	-	-	-	1	-	-	1	-	1	2	3
CO5	1	3	2	1	-	-	-	1	1	2	2	1	1	3	3

Advanced Construction Materials

Sem VII

General Course Information

Course Code: PEC-CVE454-T Course Credits: 3 Mode: Lecture (L) Type: PEC-III Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Explain about advance construction material, special concretes and special constructions	L2 (Understanding)
CO2	Use advance construction material for special constructions	L3(Applying)
CO3	Examine different construction material for specialized constructions	L4(Analyzing)
CO4	Select appropriate construction material for tunneling and formwork, high rise structures	L5 (Evaluating)
CO5	Designing fire resistant and low cost houses.	L6 (Creating)

Course Contents

UNIT-I

Advanced Construction Materials: Plastics, Timber products and Preservation, materials for thermal insulation, materials for sound insulation. Smart Materials and their applications.

UNIT-II

Special Concretes: Light Weight Concrete, Vaccuum Concrete, Waste Material Based Concrete, Fiber reinforced concrete, Polymer Concrete Composites, Ferrocement, Concreting at High and Low Temperatures, Self - Compacting Concrete (SCC), Ready Mixed Concrete (RMC) and its characteristics and advantages, Shotcrete and concreting in tunnels.

UNIT-III

Techniques for Tunneling and Formwork: Earthwork including cut and cover method, TBM, EBM and trenchless technology, Slip Form Shuttering, Latest type of Formwork, e.g. DOKA.

High Rise Structures: Construction techniques for high rise buildings, chimneys, dams. Special problems of high-rise construction & optimization of space

UNIT-IV

Fire Resistance in Structures: Fire hazards in buildings and preventive measures,

Low Cost Housing: Types, Design and advantages.

Special Constructions: Pre-Cast and Pre-Fabricated Construction and Modular Construction, production and utilization in various types of structures, Environmental and Economic Benefits.

REFERENCE BOOKS

1. Low Cost Houses, Publications by HUDCO, India Habitat Centre, Lodhi Road, New Delhi(1982)

2. F. Glower, Structural Pre-cast Concrete, Oxford Publishers.(1974)

3. Neil Jackson and R. K. Dhir, Civil Engineering materials, Macmillan Fourth edition.(1996)

4. M.L. Gambhir, Neha Jamwal, Building Materials, Products, properties and systems, Mc Graw Hill(2011)

5. M.L. Gambhir, Concrete Technology, Mc Graw Hill(2013)

6.. Subir Sarkar, Subhajit Sarawati, Construction Technology, Oxford University Press (2008).

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	2	2	-	2
CO2	2	1	1	1	-	-	-	-	-	-	-	2	2	-	3
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	-	3
CO4	2	3	3	2	-	-	-	-	-	-	-	2	2	-	3
CO5	2	3	3	2	-	-	-	-	-	-	-	2	2	-	3

Advanced Construction Techniques
Sem VII

General Course Information

Course Code: PEC-CVE455-T Course Credits: 3 Mode: Lecture (L) Type: PEC-III Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Describe advance construction techniques for different types of structures.	L2(Understanding)
CO2	Use advance construction techniques for sub structure, super structure and special structures	L3(Applying)
CO3	Examine different construction techniques for various type of constructions	L4 (Analyzing)
CO4	Select appropriate civil engineering techniques for rehabilitation, strengthening and demolition of structures	L5 (Evaluating
CO5	Constructing earth quake resistant structures	L6 (Creating)

Course Content

UNIT-I

Sub Structure Construction: Box jacking, Pipe jacking ,Under water construction of diaphragm walls and basement ,Tunneling techniques ,Piling techniques ,Driving well and caisson ,sinking cofferdam ,cable anchoring and grouting ,Driving diaphragm walls, Sheet piles ,Laying operations for built up offshore system ,Shoring for deep cutting ,Large reservoir construction ,well points ,Dewatering for underground open excavation.

UNIT-II

Super Structure Construction For Buildings : Vacuum dewatering of concrete flooring, Concrete paving technology ,Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections ,Erection techniques of tall structures, Large span structures ,launching techniques for heavy decks, in-situ pre-stressing in high rise structures, Post tensioning of slab,aerial transporting –Handling and erecting lightweight components on tall structures

UNIT-III

Construction Of Special Structures: Erection of lattice towers, Rigging of transmission line structures ,Construction sequence in cooling towers, Silos, chimney, sky scrapers ,Bow string bridges, Cable stayed bridges ,Launching and pushing of box decks ,Construction of jetties and break water structures –Construction sequence and methods in domes –Support structure for heavy equipment and machinery in heavy industries –Erection of articulated structures and space decks.

UNIT IV

Rehabilitation And Strengthening Techniques :Seismic retrofitting, Strengthening of beams, Strengthening of columns, Strengthening of slab, Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation, Micro piling and underpinning for strengthening floor and shallow profile, Sub grade water proofing, Soil Stabilization techniques.

Demolition : Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

REFERENCE BOOKS:

1. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
3. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
4. Peter.H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	-	-	-	-	-	1	2	2	-	2
CO2	2	2	2	2	1	-	-	-	-	-	1	2	2	-	3
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	-	3
CO4	2	3	3	3	2	-	-	-	-	-	1	2	2	-	3
CO5	2	3	3	3	2	-	-	-	-	-	2	2	2	-	3

Foundation Engineering

Sem -VIII

General Course Information:

Course Code: PEC-CVE456-T Course Credits: **3** Mode: Lecture (L) Type: PEC-IV Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand concepts of foundation engineering	L2 (Understanding)
CO2	Employ various methods of soil exploration for foundation engineering	L3 (Applying)
CO3	Analyze and determine earth pressure behind a retaining structure - for various soil and loading conditions.	L4 (Analyzing)
CO4	Evaluate the use of soil stabilization and geo-textiles in foundation engineering	L5 (Evaluating)
CO5	Develop and design various types of foundations for Civil Engineering works	L6 (Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Introduction to soil exploration: Scope- Methods of soil exploration- spacing- significant depth-boring and sampling techniques- types of samples- sample disturbances- penetration tests (Standard Cone Penetration Test and Standard Penetration Test)- and Geophysical methods (Seismic Refraction Method & Electrical Resistivity Method).

Earth Pressure: Earth Pressures at rest condition- states of plastic equilibrium- Rankine's theory for active and passive conditions- Influence of surcharge- water table- wall friction - Numerical Problems for the determination of Active and Passive Earth Pressure diagrams- Critical height of an Unsupported Vertical Cut.

UNIT-II

Stability of Slopes: Infinite slopes- Critical Depth of a cohesive Infinite Slope- types of failure- Swedish Slip Circle Method- Taylor's stability Number and Stability Curves- Concept of factors of safety- Bishop's Method of slices- Effect of sudden draw down and submergence.

Design of Shallow Foundation: Bearing Capacity- Definitions- depth of foundation- Terzaghi's general bearing capacity equation- IS code equation- factors affecting bearing capacity- Influence of eccentric and inclined loads. Bearing capacity by penetration tests- Plate load test.
Design Criteria for Shallow Foundations- Stability- Shear- and Settlement Failures

UNIT-III

Pile Foundations: Types- function- selection of piles- pile driving formulae- point- bearing and friction piles. Load carrying capacity of single pile- group action- spacing of piles- Negative skin friction- Concept of under reamed piles.
Caissons and Wells: Introduction-components- shapes- stability of well foundation- sinking of well- tilts and shifts.

UNIT-IV

Drainage and Dewatering of Soil: Methods of Ditches and Sump- Well Point System- Shallow Well System- Deep Well Drainage- Vacuum Method- Electro Osmosis Method- Seepage Analysis for various conditions of Fully penetrating slot and partially penetrating slot- Protective Filters.
Soil stabilization and Geo-textiles: Need and advantages of Ground Improvement techniques- Stabilization (Mechanical- Lime- Cement- bitumen- Chemical) of Soils and its advantages- Geo-textiles (Concept- Types- Functions- Use of Geo-textiles in Earth Dam Construction- Road Works- Railway works- Erosion Control and in Bearing capacity Improvement

REFERENCES BOOKS:

1. Foundation Analysis and Design- by J.E. Bowles McGraw Hill Book Company- NewYork.

2. Foundation Engineering by Peck- Wiley Eastern India Limited- New Delhi.

3. . Soil Dynamics and Machine Foundations by Swami Saran- Galgotia Publishers- New Delhi

4.. Basic and Applied Soil Mechanics- by Gopal Ranjan Rao- ASR Rao- New Age Int. (P) Ltd. Pub.- New Delhi.

5.Soil Mechanics and Foundations by B. C. Punmia- Ashok Kumar Jain & Arun Kumar Jain- Laxmi Publications- New Delhi.

6.Soils and Foundations- by Cheng Liu & Jack B Evett- Prentice-Hall Inc.- USA.

7.A Text Book of Soil Mechanics Foundation Engg. by VNS Murthy – U.B.S- New Delhi.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	-	-	-	-	-	-	-	2	1	-	2
CO2	2	2	1	2	-	-	-	-	-	-	-	2	2	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	3	-	3
CO4	2	2	3	3	-	-	-	-	-	-	1	2	2	-	3
CO5	2	2	3	3	-	-	-	-	-	-	1	2	2	-	3

Ground Improvement

Sem -VIII

General Course Information:

Course Code: PEC-CVE457-T Course Credits: 3 Mode: Lecture (L) Type: PEC-IV Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Understand the need, mechanism and importance of ground improvement.	L2(Understanding)
CO2	Apply appropriate method of ground improvement as per requirement of the soil properties.	L3(Applying)
CO3	Apply appropriate method of Soil Reinforcement, Anchored Earth or Soil Nailing, Grouting etc.	L4 (Analyzing)
CO4	Design the reinforced earth retaining walls, abutments, earth slopes etc.	L5 (Evaluating

Course Contents

UNIT I

Introduction to different methods of ground improvement and its importance. Mechanical method of ground improvement, Ruthfuch method; methods based on PI.
Ground Freezing, methods, Hydrogeology of frozen soils, strength and behaviour of frozen soils. Ground heating, effect on soil properties, methods.

UNIT II

Drainage Techniques, filter drains, sand drains, sand wicks & band drains, lime columns. Electro-osmosis and Electrochemical stabilization.

Compaction & consolidation techniques viz. pre-compression, compaction piles, vibro-compaction (Vibro-floatation, Terra-probe, vibro-replacement, concrete columns &vibro-displacement), Dynamic compaction, explosive compaction.

UNIT III

Soil Reinforcement, load transfer mechanism, strength development, anchored earth. In-situ reinforcement techniques viz soil nailing, reticuled micropiles, soil dowels and anchors.
Grouts, properties, penetration, clay, cement clay, cement, clay-chemical, chemical and Bituminous grouts, grouting methods viz penetration, claquage, compaction & jet.

UNIT IV

Reinforced earth; Introduction, Mechanism of reinforced types of reinforcement strength characteristics. Design of reinforced earth retaining walls, abutments, earth slopes.

Exclusion techniques viz. sheet piles, contiguous bored piles, secant piles, slurry trenches. Diaphragm walls. Design of stone columns.

Text Books

1. Ground Improvement Techniques by P. Purushotham Raj, Tata McGraw Hill, ND.
2. Engineering Treatment of Soils by F.G. Bell, E & FN Spon Publishers, UK.

Reference Books

1. Engineering Principles of Ground Modification by M.R. Hausmann, McGraw Hill Publishers, New York.
2. Ground Improvement Techniques & their Evolution by W.F. Van Impe., A.A. Balkema Publishers, Netherlands.
3. Koerner, R.M., Construction & Geotechnical methods in foundation engineering, MGH, New York,1985
4. Bowle's.J.E., Foundation Analysis and design,4th edition,MGL,1998.
5. Jones.C.J.F.P., Earth reinforcement and soil structures, Butter worth &co., London,1985
6. Arora.K.R., Soil mechanics and foundation Engineering,SPD,2001

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	-	-	-	-	-	-	-	2	1	-	2
CO2	2	2	1	2	-	-	-	-	-	-	-	2	2	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	3	-	3
CO4	2	2	3	3	-	-	-	-	-	-	1	2	2	-	3

Geotechnical Design

Sem -VIII

General Course Information:

Course Code: PEC-CVE458-T Course Credits: 3 Mode: Lecture (L) Type: PEC-IV Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Perform the geotechnical design of Earth Retaining Structure.	L3(Applying)
CO2	Analyze and Design of Earthen Embankments, with or without filters, for various conditions of Drainage.	L4 (Analyzing)
CO3	Design geotechnically the Shallow Foundations and Pile Foundations.	L5 (Evaluating)
CO4	Design the Surface and Sub-surface drainage system for roads and Design the Sub-grade for highways and airfield pavements.	L6 (Creating)

Course Contents

UNIT I

Engineering Design Process of Shallow Foundations: Geotechnical and Structural Design, Design Water Table Level, Design Soil Parameters, Determination of representative design S_u value, Determination of N''_{des} in sands, Strata and design parameters, Foundations and zone of influence and design parameters to be used, A multi-layered deposit and the relevant design parameters.

Design Criteria and Design Report of Shallow Foundations: Loads on Foundations, Foundation Types and Choice of Foundations, Design Criteria, Acceptable Settlement, Acceptable Safety against Bearing Capacity failure, Geotechnical design of shallow foundations, Foundation Location, Foundation shape and range of widths, Settlement and bearing Capacity Analyses, Reporting of Results and Recommendations for Geotechnical Design of foundation.

UNIT II

Engineering Design Process of Pile Foundations: Identifying a strong bearing layer for locating the pile tip, Selection of Pile type, Range of Pile lengths and Diameters, Mini or Micro Piles, Barrettes, Negative Skin Friction, Bearing Capacity of Deep Foundations, Pile Group and Group Capacity.

Design Criteria and Design Report of Pile Foundations: Estimating axial pile capacity, Determining Unit end bearing and unit skin friction, Determining axial pile load capacity in different soil profiles, Determining axial pile load capacity for pipe piles, Estimating Axial Pile capacity by pile load test approach, Estimating axial pile capacity by driving

resistance approach, Settlement Analysis, Reporting of Results and Recommendations for Geotechnical Design of pile foundation.

UNIT III

Sub-surface drainage for Roads: Significance of Drainage, Requirements of Highway Drainage System, Collection of Surface Water through Covered Drainage trenches, Lowering of High-Water Table in Permeable Soils, Subsurface Drainage System with Transverse Drains, Control of seepage flow, Control of capillary rise, Design of Sub-surface Drainage System, Road Construction in water logged areas.

Analysis and Design of Sub-grade for highways and airfield pavements: Significance and Desirable Properties of Subgrade soil, Group Index of soil, Characteristics of soil classification groups, Suitability of soil as subgrade material, Subgrade Soil strength, Modulus of Subgrade Reaction, Allowance of worst subgrade moisture, California Bearing ratio Test and CBR method of design of flexible pavement thickness and its subgrade.

UNIT IV

Earthen Embankments: Types of Earthen Embankments, Protective Layers for erosion control, Toe Drainage, Effect of sudden draw down and submergence. Unstability of the Upstream and Downstream slopes due to seepage forces, Typical range of prescribed safety factors for stability of slopes of earth dams, Design Process, Performance and health Monitoring using instrumentation, Road, Rail and other embankments.

Earth Retaining Structures: Types of Earth Retaining Structures, Types of Retaining walls, Design of retaining walls, Design Criteria, Design Process, Backfill material, Drainage provisions in the backfill, Tentative dimensions, Earth Pressure diagram and Influence of Soil Displacement, Sliding Resistance, Overturning, Pressure distribution along base, Determination of final dimensions and the force and stress diagram for proceeding with the structural design.

Text Books:

1. Geotechnical Engineering, by Sashi K. Gulhati and Manoj Datta, Tata McGraw Hill Education Private Limited, New Delhi.
2. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain &Arun Kumar Jain, Laxmi Publications, New Delhi.
3. Soil Mechanics & Foundation Engineering, by K.R. Arora, Standard Publishers, New Delhi.
4. Highway Engineering by S.K. Khanna and C.E.G. Justo, Nem Chand and Bros., Roorkee.
5. Modern Geotechnical Engineering by Alam Singh.

References Books:

1. Foundation Analysis and Design, by J.E. Bowles McGraw Hill Book Company, NewYork.
2. Soil Mechanics and Foundation Engineering, Hasmukh P Oza and Gautam H Oza, Charotar Publishing House, ANAND, Gujarat, India.
3. A Text Book of Soil Mechanics Foundation Engg. by VNS Murthy – U.B.S, New Delhi.
4. Basic and Applied Soil Mechanics, by Gopal Ranjan Rao, ASR Rao, New Age Int. (P) Ltd. Pub., New Delhi.
5. Foundation Engineering by Peck, Wiley Eastern India Limited, New Delhi.
6. Soils and Foundations, by Cheng Liu & Jack B Evett, Prentice-Hall Inc., USA.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	-	-	-	-	-	-	-	2	1	-	2
CO2	2	2	1	2	-	-	-	-	-	-	-	2	2	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	3	-	3
CO4	2	2	3	3	-	-	-	-	-	-	1	2	2	-	3

Irrigation & Design of Hydraulic Structures
Sem VIII

General Course Information:

Course Code: PEC-CVE460-T Course Credits: 3 Mode: Lecture (L) Type: PEC-V Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Explain concepts and designs of hydraulic structures and water distribution systems for irrigation.	L2 (Understanding)
CO2	Compute the irrigation water requirement of crops.	L3 (Applying)
CO3	Analyzing alignments for construction of water distribution system and construction of hydraulic structures for them.	L4(Analyzing)
CO4	Evaluate the water losses in canal & systems	L5(Evaluating)
CO5	Help in designing of hydraulic structures for irrigation water distribution systems.	L6(Creating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Water requirement of crops: Irrigation systems: Need-minor and major- command area development - Crops and crop seasons in India - cropping pattern- duty and delta - Quality of irrigation water- Soil-water relationships: soil characteristics significant from irrigation considerations- root zone soil water- infiltration- consumptive use- irrigation requirement- frequency of irrigation - Methods of applying water to the fields: surface - sub-surface - sprinkler and trickle / drip irrigation

Reservoirs: Types- capacity of reservoir- fixing of control levels - yield of reservoir- reservoir regulation- erosion and sedimentation- economic height of dam- selection of suitable site.

UNIT-II

Dams and spillways: Embankment dams: Classification- selection of site for dam- design considerations- estimation and control of seepage- slope protection Gravity dams: forces on gravity dams- causes of failure- elementary and

practical profile- structural joints- keys and water seals- galleries- outlets- Arch and buttress dams: types Spillways: components of spillways- types- terminal structures- types of gates for spillway crests Weir and barrage- types of weirs- Theories of seepage for design of weirs

UNIT-III

Distribution system: Canal systems- alignment of canals- canal losses- estimation of design discharge Design of channels: Kennedy's and Lacey's theory of regime channels Canal
outlets: non-modular- semi-modular and modular outlets Water logging: causes- effects and remedial measures- Lining of canals: economics of lining- types of lining- Drainage of irrigated lands: necessity- methods

UNIT-IV

Hydraulic structures for distribution system: Surface and sub-surface flow considerations for design of canal structures: hydraulic jump- seepage forces- uplift forces Canal falls- cross regulator- distributary head regulator- canal escapes: types- components and design considerations
Cross drainage works: need- types- design considerations different units of headworks- sediment control in canals- river training for canal headworks-

REFERENCE BOOK:

1. G L Asawa- Irrigation Engineering- Wiley eastern
2. S K Garg- Irrigation Engineering & Hydraulic Structures- Khanna Publishers
3. P N Modi- Irrigation Engineering & Hydraulic Structures
4. Bharat Singh- Fundamentals of Irrigation Engineering- Nem Chand- Roorkee(1988)
5. S.R. Sahasrabudhe- Irrigation Engineering and Hydraulic Structures- S K Kataria & Sons- New Delhi(2014)
6. P Novak- A I BMoffat- C Nalluri& R Narayanan- Hydraulic Structures- Taylor &Francis(2014)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	-	-	-	-	-	1	2	2	-	2
CO2	2	2	2	2	1	-	-	-	-	-	1	2	2	-	3
CO3	2	2	2	2	1	-	-	-	-	-	1	2	2	-	3
CO4	2	3	3	3	2	-	-	-	-	-	1	2	2	-	3
CO5	2	3	3	3	2	-	-	-	-	-	2	2	2	-	3

Open Channel Flow
Sem VIII

General Course Information:

Course Code: PEC-CVE461-T Course Credits: 3 Mode: Lecture (L) Type: PEC-V Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Outline types of flow in river and channels	L1 (Remembering)
CO2	Understand flow patterns and dynamics through open channels.	L2 (Understanding)
CO3	Select and utilize hydraulic machine correctly according to the circumstances	L3 (Applying)
CO4	Examine the hydraulic jump pattern and its applications.	L4 (Analyzing)
CO5	Evaluating the importance of various hydraulic machines	L5 (Evaluating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Flow in Open Channels: Difference between pipe flow and channel flow- Types of channels- Classification of flows- Sub Critical and Supercritical Flows- Velocity distribution in channel.

Flow Measurement: Flow over notches and weirs- Pitot tube floats and current meters for velocity measurement- Flow over Spillways- Sluice gates- Free overfell flow.

UNIT-II

Unsteady flow and Hydraulic jump: Froude number and types of hydraulic jump- Applications Jumps in channels. Unsteady flow equation- Pre jump and post jump depths- length of Hydraulic Jump and energy dissipation- Surges.

Concepts of Specific energy and specific Force: Specific energy and specific curve- Momentum Equation in open channels- Specific force & specific force curve Critical depth and its computation.

UNIT-III

Gradually Varied Flow: Channel transitions- Non-uniform flow in open channels- Dynamic equation for GVF- Water surface profiles in channels of different slopes GVF flow computations. Design of Channels- Most efficient channel sections.

UNIT-IV

Pumps and Turbines: Reciprocating pumps- their types- work done by single and double acting pumps. Centrifugal pumps- components and parts and working- types- heads of a pump-statics and manometric heads- Force executed by fluid jet on stationary and moving flat vanes.- Turbines-classifications of turbines based on head and specific speed-component and working of Pelton wheel and Francis turbines- Cavitation.

REFERENCE BOOKS:

1. K. Subramanya- "Flow in Open Channels"- Tata McGraw Hill- New Delhi.
2. K.G. Ranga Raju- "Flow Through Open Channels"- Tata McGraw Hill- New Delhi.
3. F. M. Hendersen- "Open Channel Flow"- McMillan- New York.
4. R. H. French- "Open-Channel Hydraulics"- McGraw Hill Publishing Company- New York.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	1	2	1	-	2
CO2	2	2	1	2	-	-	-	-	-	-	1	2	1	-	2
CO3	2	2	1	2	-	-	-	-	-	-	1	2	2	-	3
CO4	2	2	1	2	-	-	-	-	-	-	1	1	2	-	2
CO5	2	3	1	3	-	-	-	-	-	-	1	2	2	-	3

Groundwater Engineering
Sem VIII

General Course Information:

Course Code: PEC-CVE462-T Course Credits: 3 Mode: Lecture (L) Type: PEC-V Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Define the discharge in well for different aquifers.	L1(Remembering)
CO2	Learn the principles and dynamics of groundwater flow.	L2 (Understanding)
CO3	Use various methods for ground water exploration	L3 (Applying)
CO4	Examine the reasons of groundwater depletion and fluctuations	L4 (Analyzing)
CO5	Appraise the principles of well hydraulics and methods of well construction.	L5 (Evaluating)

*Revised Bloom's Taxonomy

Course Contents

UNIT-I

Principles of Ground water flow: Definition and occurrence of ground water flow- Role of ground water in a hydrologic cycle- Mechanical energy and fluid potential- Hydraulic head- Darcy's law- Heterogeneity and anisotropy- Range and validity of Darcy's law- Types of aquifer and its properties- Compressibility- Specific storage- Storativity- Ground water flow equation- Solution of flow equation- Analytical solutions- Steady flow in a confined and unconfined aquifer- Graphical solutions- Flow lines and Equipotential lines- Flow net- Refraction of flow lines.

UNIT-II

Well Hydraulics: Introduction- Drawdown due to abstraction from well- Steady and unsteady abstraction from well- Well interference- Pumping test analysis- Infiltration wells and gallery.

Well Construction: Method of construction of shallow and deep well- well log- well completion- horizontal well

UNIT-III

Groundwater Conservation: Regional groundwater budget- Resource assessment- Estimation of recharge- artificial recharge.

Groundwater quality: Indian and international standards- Pollution of groundwater sources- Advection and dispersion- sorption and diffusive mass transfer- remedial and preventive measures.

UNIT-IV

Exploration: Geophysical- Electric resistivity method- Seismic refraction method- Saline water intrusion in aquifers- Groundwater levels fluctuation.

REFERENCE BOOKS:

1. Raghunath H M- Groundwater- New Age International(2007).
2. David Keith Todd- Groundwater Hydrology- Wiley India Edition(2007).
3. Franklin W. Schwartz and Hubao Zhang- Fundamentals of Groundwater- John Wiley(2003).
4. Bear- J. Hydraulics of Groundwater- McGraw-Hill(1979).
5. Freeze- R.A. and Chery- J.A- Groundwater. Prentice Hall-Inc- Englewood Cliffs- New Jersey(1979)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	2	1	-	2
CO2	2	2	1	2	-	-	-	-	-	-	-	2	1	-	2
CO3	2	2	1	2	2	-	-	-	-	-	-	2	2	-	2
CO4	2	2	1	1	1	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	2	2	-	-	-	-	-	-	2	2	-	3

Open Elective Course(s) offered to other Departments

Sr. No.	Semester	Course Title	Course Code
1	5th	Introduction to Civil Engineering	OE-CE391-T
2	6th	Introduction to Road Safety Audit	OE-CE392-T
3	7th	Air & Noise Pollution Control	OE-CE491-T

Introduction to Civil Engineering

Sem-V

General Course Information:

Course Code: OE-CE391-T Course Credits: 3 Mode: Lecture (L) Type: OE-I Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No.	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1.	Introduction to what constitutes Civil Engineering	L1(Remembering)
CO2.	Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering	L2(Understanding)
CO3.	Analyzing various possibilities of a career in this field	L4(Analyzing)
CO4.	Evaluate the depth of engagement possible within each of these areas	L5(Evaluating)

Course Contents

UNIT-I

Stones -Characteristics of good building stones-common building stones and their uses, Bricks- Classification of bricks, constituents of good brick earth, harmful ingredients, manufacturing of bricks, testing of bricks. Timber-Classification of Timber and their uses-Cement-Types of cement and their uses, Components of sub structure and their functions-Components of super structure and their functions, Concrete- Ingredients of concrete and its importance in construction

UNIT-II

Modes of transportation – Classification of highways - Classification of pavements – Super elevation. Overview of Road accidents in India and various important initiatives taken by MORTH. Origin of soil – types of soil – bearing capacity of soil – Types of foundation – shallow and deep.

UNIT-III

Definition and classification of irrigation, Introduction to Solid waste management, Methods to mitigate the solid wastes, Water purification, Wastewater treatment & Recycling.

UNIT-IV

Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity, Sustainability measures; Innovations and methodologies for ensuring Sustainability. Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects.

REFERENCES

1. B C Punmia, Ashok K Jain, Arun K Jain, (1st Edition, 2003), "Basic Civil Engineering", Laxmi Publications (P) Ltd.

2. G K Hiraskar, (1st Edition, 2004), "Basic Civil Engineering", Dhanpat Rai Publication.

3. Civil Engineering-Societal and Global Impact Dr. R.P. Rethaliya

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	--	-	2	1	-	-	-	-	-	1	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	3	2	1	-	-	-	-	-	-	1	-	3	-	2
CO4	-	-	2	-		2	1	-	-	-	--	1	-	-	2

Introduction to Road Safety Audit

Sem VI

General Course Information

Course Code: OE-CE392-T Course Credits: 3 Mode: Lecture (L) Type: OE-II Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

S. No.	**Course outcomes** At the end of the course students will be able to:	RBT* Level
CO1	Know about road safety scenario in India and the need of planning and design for safety	L2 (Understanding)
CO2	Generate awareness about number of people dyeing every year in road accidents, traffic rules and characteristics of accident.	L3 (Applying)
CO3	Understand the concepts of various stages of road safety audit and methods of prioritization of audit recommendations.	L4 (Analyzing)
CO4	Acquire a certificate of coordination/ participation in compulsory events based on the topic under study	L5 (Evaluating)

Course Content

UNIT- I

Introduction to Road Safety: Road traffic accidents scenario in India and in world. Road Safety and its importance. Traffic Rules and Driving Behavior. Characteristics of road crashes, accidents vs. crash, Black spot identification, safety performance functions and accident modification factors.

UNIT – II

Road Safety Auditing- An Introduction, How to Conduct Road Safety Audit, Design Stage Road Safety Audit, Road Safety Audits of Land Use Developments, Traffic Control Devices & Safety, Needs of Different Road Users, Road Safety Audit in Road Works & Pre-Opening Safety Audit.

Street Lighting & Traffic Signals, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

UNIT – III

Safe System Approach- A Global Perspective, Speed Management & safety, Safe System and Speed & Assessing speed limit, Type of speed limit & Speed zone signing Infrastructure to support safe speed feedback and enforcement.

Hazard Management Organizational commitment & encouraging RSA, Road Safety Audit Checklist.

UNIT – IV

Site Visits and Preparation of the Audit Reports.

Risk Assessment & Prioritization of audit recommendations, Solutions and effectiveness & Corrective, Action Report.

Text Books

1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Highway Engineering by L.R. Kadyali, Nem Chand & Brothers, Roorkee

Reference Books

7. Highway Engineering by Oglesby and Hews
8. Transportation Engineering by G.V. Rao, Tata McGraw Hill Publisher, New Delhi
9. Traffic Engineering by Matson,Smith&Hurd
10. Road safety audit Manual
11. Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996
12. Indian Roads Congress, Road Safety Audit Manual, IRC: SP-88-2019.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	2	2	-	1
CO2	2	1	1	-	-	1	1	1	1	-	-	-	2	-	2
CO3	2	2	2	1	-	1	-	-	-	-	-	1	2	-	3
CO4	-	-	-	-	-	2	2	-	-	2	2	2	2	-	3

Air & Noise Pollution Control

Sem VII

General Course Information:

Course Code: OE-CE491-T Course Credits: 3 Mode: Lecture (L) Type: OE-III Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods (internal: 30; external: 70) Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end semester examination will be of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Course outcomes

Sr. No	Course outcomes At the end of the course students will be able to:	RBT* Level
CO1	Understand sources of air pollution, air pollution problems	**L1(Remembering)**
CO2	Demonstrate a detailed knowledge of study the effect of meteorological parameters in the dispersion of air pollutants	**L3(Applying))**
CO3	Analyze Environment legislation and regulations for air and noise pollution	**L4(Analyzing)**
CO4	Evaluate efficiency of various air pollution control devices used for particulate removal	**L5(Evaluating)**
CO5	Design, operate and control the devices used for gaseous emission control and noise emission control	**L6(Creating)**

Course Contents

UNIT-I

Air pollutants, Sources, classification, Combustion Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects, Smoke, smog and ozone layer disturbance, Greenhouse effect.

UNIT-II

Air sampling and pollution measurement methods, principles and instruments, ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations

UNIT-III

Control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and

other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.

UNIT-IV

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods

REFERENCE BOOKS

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2000.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt. Ltd, New Delhi, 1993.
3. G.K. Nagi, M.K. Dhillon, G.S. Dhaliwal, Commonwealth Publishers, Noise Pollution.
4. S.K. Garg, Khanna publishers, Sewage Disposal and Air Pollution Engineering.
5. S.M. Khopkar, Environmental pollution analysis, New Age International Publications

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	1	-	-	-	1	1	-	-
CO2	1	2	3	-	-	1	2	1	-	-	1	1	1	2	3
CO3	1	3	-	-	-	1	2	1		1	1	2	3	-	1
CO4	-	2	3	2	-	1	2	-	-	-	2	2	1		3
CO5	-	2	3	1	-	1	2	-	2	-	2	3	1	3	2