SGT University, Chandu-Budhera, Gurugram
Faculty of Engineering & Technology
Department of Civil Engineering

B. Tech. **Civil Engineering**

Scheme & Syllabus (2021-22)

Vision of SGT University

"Driven by Research & Innovation, we aspire to be amongst the top ten Universities in the Country by 2022"

Scheme of Examination for B.Tech. (Civil Engineering) Program, 1st year

SEMESTER WISE COURSE STRUCTURE 2021-2022

First Semester

S. No.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1		Applied Mathematics	3	0	0	3	40	60	100
2		Design Thinking	3	0	0	3	40	60	100
3		Basics Surveying	3	0	0	3	40	60	100
4		Engineering Mechanics	3	0	0	3	40	60	100
5		Basic of Materials	3	0	0	3	40	60	100
6		Materials Lab	0	0	2	1	60	40	100
7		Value Addition Course-I	2	0	0	2	40	60	100
8		Basic Surveying Lab	0	0	2	1	60	40	100
9		Workshop Technology Lab	0	0	2	1	60	40	100
10		Engineering Graphics and Design Lab	0	0	2	1	60	40	100
11		Ability Enhancement Courses-1	2	0	0	2	40	60	100
		Total	**19**	**0**	**08**	**23**	**520**	**580**	**1100**

Grade*

Score	Grade
90 marks and above	O (Outstanding)
80 marks and above but less than 90 marks	A+ (Excellent)
70 marks and above but less than 80 marks	A (Very Good)
60 marks and above but less than 70 marks	B+(Good)
50 marks To 60 marks	B (Above Average)
Below Minimum Pass marks	F(Fail)

Second Semester

S. No.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1		Applied Physics	3	0	0	3	40	60	100
2		Advanced Surveying	2	0	0	2	40	60	100
3		Building Construction and Materials	2	0	0	2	40	60	100
4		Concrete Technology	3	0	0	3	40	60	100
5		Elements of Environmental Engineering	3	0	0	3	40	60	100
6		Advanced Surveying Lab	0	0	2	1	60	40	100
7		Environmental Analysis Lab	0	0	2	1	60	40	100
8		Building Construction and Materials Lab	0	0	2	1	60	40	100
9		Biology for Engineers	2	0	0	2	40	60	100
10		Object Oriented Programming Lab	0	0	2	1	60	40	100
11		Ability Enhancement Courses-2	2	0	0	2	40	60	100
		Total	**17**	**0**	**08**	**21**	**520**	**580**	**1100**

Grade*

Score	Grade
90 marks and above	O (Outstanding)
80 marks and above but less than 90 marks	A+ (Excellent)
70 marks and above but less than 80 marks	A (Very Good)
60 marks and above but less than 70 marks	B+(Good)
50 marks To 60 marks	B (Above Average)
Below Minimum Pass marks	F(Fail)

Note:-

1. 4 weeks mandatory Industrial Internship of 2 credits after completetion of 1st year.

***** A student will be eligible to get Under Graduate degree with **Honors**, if he/she completes an additional 16 credits. These can be acquired through SWAYAM MOOCs. For that, one MOOC Course of atleat 8 weeks (4 credits) must be completed during First Year. The list of MOOC courses will be provided by the Departement to the students before commencement of the semester.

Exit Point

Certification Course in Civil Engineering.

Entry Point

Three years Diploma or One year Certificate Course in Basics of Civil Engineering and in lieu of Industrial Internship of 4 weeks student has to complete MOOC Course of 4 weeks (2 Credits) in 3rd semester.

Scheme of Examination for B.Tech. (Civil Engineering) Program 2nd year

SEMESTER WISE COURSE STRUCTURE 2021-2022

Third Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Fluid Mechanics	3	0	0	3	40	60	100
2.		Strength of Materials	3	0	0	3	40	60	100
3.		Department Electives-I	3	0	0	3	40	60	100
4.		Department Electives-II	3	0	0	3	40	60	100
5.		Open Elective-I	4	0	0	4	40	60	100
6.		Fluid Mechanics Lab	0	0	2	1	60	40	100
7.		Strength of Materials Lab	0	0	2	1	60	40	100
8.		Department Electives Lab-I	0	0	2	1	60	40	100
9.		Department Electives Lab-II	0	0	2	1	60	40	100
10.		Value Addition Course-II	2	0	0	2	40	60	100
11.		Ability Enhancement Courses-3	2	0	0	2	40	60	100
12.		Industrial Internship	0	0	4w	2	60	40	100
		Total	**20**	**0**	**8**	**26**	**580**	**620**	**1200**

Scheme of Examination for B.Tech. (Civil Engineering) Program 2nd year

SEMESTER WISE COURSE STRUCTURE 2021-2022

Fourth Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Soil Mechanics	3	0	0	3	40	60	100
2.		Structural Analysis	3	0	0	3	40	60	100
3.		Department Electives-III	3	0	0	3	40	60	100
4.		Department Electives-IV	3	0	0	3	40	60	100
5.		Open Elective-II	4	0	0	4	40	60	100
6.		Soil Mechanics Lab	0	0	2	1	60	40	100
7.		Structural Analysis Lab	0	0	2	1	60	40	100
8.		Department Electives Lab-III	0	0	2	1	60	40	100
9.		Department Electives Lab-IV	0	0	2	1	60	40	100
10.		Research Methodology	3	0	0	3	40	60	100
		Total	**19**	**0**	**8**	**23**	**480**	**520**	**1000**

Note: -

1. 6 weeks mandatory Industrial Training-I of 2 credits after completetion of 2nd year.
2. Student can opt for any of the Open Elective subject outside from the Parent Institute leading to Holistic development of student. It may include Yoga, Dance, Fashion, Agriculture, Medicine, etc.
3. Hours for open elective may vary as per course but not credits.
4. The Department has liberty to vary Credits of Core Courses Lab but not for Department Electives Lab. The Department Elective Labs are significant. So, there hours not to be reduced.
5. Department Electives must be selected such that they should not have any year-wise dependency.

***** A student will be eligible to get Under Graduate degree with **Honors'**, if he/she completes an additional 16 credits. These can be acquired through SWAYAM MOOCs. For that, one MOOC Course of atleat 8 weeks (4 credits) must be completed during Second Year. The list of MOOC courses will be provided by the Departement to the students before commencement of the semester.

****** 2nd Year Core Courses along with 4 Department Elective Courses should make a capsule program with some specialization.

Sr. No	Specialization	Departmental Elective-I	Departmental Elective-II	Departmental Elective-III	Departmental Elective-IV
1	**Water Resource Engineering**	Ground Water Engineering	Urban water resources management	Hydrology	Water Resources Systems Planning
2	**Geotechnical Engineering**	Engineering Geology	Ground Improvement	Engineering Behavior of Rocks	Environmental Geotechnology
3	**Construction Management**	Civil Engineering Materials	Construction methods and Equipments	Green Building Methodology	Quality & Safety Practices in construction
4	**Geo-Informatics and Remote Sensing**	Surveying Measurements and Adjustments	Principles of Photogrammetric	Remote Sensing and Image Processing	Geodesy and GPS Surveying
5	**Environmental Engineering**	Air Pollution and Control	Water Quality Management	Solid Waste Management	Natural Disaster Mitigation and management

Scheme of Examination for B.Tech. (Civil Engineering) Program 3rd year

SEMESTER WISE COURSE STRUCTURE 2021-2022

Fifth Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Highway Engineering	3	0	0	3	40	60	100
2.		Reinforced Concrete Structure	3	0	0	3	40	60	100
3.		Department Electives-V	3	0	0	3	40	60	100
4.		Department Electives-VI	3	0	0	3	40	60	100
5.		Open Elective-III	4	0	0	4	40	60	100
6.		Highway Engineering Lab	0	0	2	1	60	40	100
7.		Department Electives Lab-V	0	0	2	1	60	40	100
8.		Department Electives Lab-VI	0	0	2	1	60	40	100
9.		Ability Enhancement Courses-4	2	0	0	2	40	60	100
10.		Industrial Training-I	0	0	6w	2	60	40	100
		Total	**18**	**0**	**6**	**23**	**480**	**520**	**1000**

Scheme of Examination for B.Tech. (Civil Engineering) Program 3rd year

SEMESTER WISE COURSE STRUCTURE 2021-2022

Sixth Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Design of Steel Structures-I	3	0	0	3	40	60	100
2.		Water Treatment and Supply System	3	0	0	3	40	60	100
3.		Department Electives-VII	3	0	0	3	40	60	100
4.		Department Electives-VIII	3	0	0	3	40	60	100
5.		Open Elective-IV	4	0	0	4	40	60	100
6.		Water Treatment Lab	0	0	2	1	60	40	100
7.		Department Electives Lab-VII	0	0	2	1	60	40	100
8.		Department Electives Lab-VIII	0	0	2	1	60	40	100
9.		Value Addition Course-III	2	0	0	2	40	60	100
		Total	**18**	**0**	**6**	**21**	**420**	**480**	**900**

Note:-

1. 6 weeks mandatory Industrial Training-II of 3 credits after completetion of 1st year.
2. Student can opt for any of the Open Elective subject outside from the Parent Institute leading to Holistic Development of student. It may include Yoga, Dance, Fashion, Agriculture, Medicine, etc.
3. Hours for open elective may vary as per course but not credits.
4. The Department has liberty to vary Credits of Core Courses Lab but not for Department Electives Lab. The Department Elective Labs are significant. So, there hours not to be reduced.
5. Department Electives must be selected such that they should not have any year-wise dependency.

***** A student will be eligible to get Under Graduate degree with **Honours**, if he/she completes an additional 16 credits. These can be acquired through SWAYAM MOOCs. For that, one MOOC Course of atleat 8 weeks (4 credits) must be completed during Third Year. The list of MOOC courses will be provided by the Departement to the students before commencement of the semester.

****** 3rd Year Core Courses along with 4 Department Elective Courses should make a capsule program with some specialization.

******* Students entring directly in 2nd and 3rd year with Certifciate Course and Advanced Certification Course will be given Undergradute Diploma considering their credits of previous courses after successfully completion of 3rd year but the student need to submit his original previous certificate.

Sr. No	Specialization	Departmental Elective-V	Departmental Elective-VI	Departmental Elective-VII	Departmental Elective-VIII
1	**Water Resource Engineering**	Watershed Management	Environmental Impact Assessment and Management	Principles of Geomatics	Urban Water Management
2	**Geotechnical Engineering**	Advanced Soil Mechanics	Geotechnology	Rock Mechanics	Geotechnical Earthquake Engineering
3	**Structural Engineering**	Advanced Structural Analysis	Energy Efficient Structures	Reinforced Concrete Structures-II	Bridge engineering
4	**Construction Management**	Project Planning and Management	Quantitative Methods in Construction Managements	Contract Laws & Regulations	Concrete Construction Technology
5	**Geo-Informatics and Remote Sensing**	Analytical and Digital Photogrammetry	Advanced Digital Image Processing	Thermal, Microwave and Hyper spectral Remote Sensing	Theory and Applications of GIS
6	**Environmental Engineering**	Earth and Environment	Environmental Remote Sensing	Disaster Management	Environment Impact Assessment
7	**Transportation Engineering**	-	-	Railway and Tunnel Engineering	Airport Planning and Design

Exit Point

Undergraduate Diploma in Civil Engineering with specialization in _____.

Entry Point

Undergraduate Diploma in Civil Engineering and in lieu of Industrial Training of 6 weeks student has to complete MOOC Course of atleast 6 weeks (3 Credits) in 7^{th} semester.

Scheme of Examination for B.Tech (Civil Engineering) Program 4th year

SEMESTER WISE COURSE STRUCTURE 2021-2022 (Internship Based)

Seventh Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Estimation and Costing	3	0	0	3	40	60	100
2.		Department Electives-IX	3	0	0	3	40	60	100
3.		Department Electives-X	3	0	0	3	40	60	100
4.		Department Electives Lab-IX	0	0	2	1	60	40	100
5.		Department Electives Lab-X	0	0	2	1	60	40	100
6.		Capstone Project	0	0	4	2	60	40	100
7.		Industrial Training-II	0	0	6w	2	60	40	100
8.		Value Addition Course-IV	2	0	0	2	40	60	100
		Total	**11**	**0**	**8**	**17**	**400**	**400**	**800**

Eighth Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Industrial Internship with Project (Industrial oriented/Research oriented)	-	-	20 W	**10**	100	100	**200**
	Total Credits = 10								
	Overall Total Credits = I to VIII= 164								

***** A student will be eligible to get Under Graduate degree with **Honors'**, if he/she completes an additional 16 credits. These can be acquired through SWAYAM MOOCs. For that, one MOOC Course of atleat 8 weeks (4 credits) must be completed during Fourth Year. The list of MOOC courses will be provided by the Departement to the students before commencement of the semester.

Sr. No	Specialization	Departmental Elective-IX	Departmental Elective-X
1	**Transportation Engineering**	Transportation Planning	Urban Transit System
2	**Water Resource Engineering**	Irrigation and Drainage	Environmental Hydraulics
3	**Geotechnical Engineering**	Advanced Geotechnical Exploration and Testing	Physico Chemical Behaviour of Soils
4	**Structural Engineering**	Design of Steel Structure-II	Earthquake Engineering
5	**Construction Management**	Disaster Reduction and Management	Maintenance of Building Structure
6	**Geo-Informatics and Remote Sensing**	Geoinformatics for Natural Disasters	Geoinformatics for Land use Surveys
7	**Environmental Engineering**	Design of waste water System	Water quality modeling

Exit Point

B.Tech Degree in Civil Engineering with specialization in_____.

1st Semester

1. Name of the Department- Civil Engineering						
2. Course Name	**Applied Mathematics**	**L**	**T**		**P**	
3. Course Code		**3**	**0**		**0**	
4. Type of Course (use tick mark)		**Core (✓)**	**PE()**		**OE ()**	
5. Pre-requisite (if any)	+2 math	**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 0**			

8. Course Description

Introduction to applied mathematics and their applications like differential equations, matrix and set theory, recursive programming, multiple integrations and Laplace transform be the tool for solving the real life problems in engineering & sciences. Enhance and develop the ability of using the language of mathematics in analyzing the real world problems of sciences and engineering.

9. Learning Objectives:

- To provide basic and theoretical competencies that is majorly used in Computer Science. To help students understand and appreciate the basic mathematical knowledge which is fundamental to Computer Science.
- To aware students about computer, its functions and utilities.
- To promote the development of computer-related skills for immediate application to other curricular areas.
- To provide a foundation for post-secondary education.
- To facilitate the development and application of problem-solving skills in students.

10. Course Outcomes (COs):

The students will be able to:-

- Derive mathematical models of physical systems.
- Solve differential equations using appropriate methods.
- Present mathematical solutions in a concise and informative manner.
- Solve linear system of equations by direct, iterative methods and determine eigen values and eigen vectors of given square matrix also inverse of the matrix using Cayley Hamilton theorem.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	Matrices

Matrices, additions and scalar multiplication, matrix multiplication; Linear system of equations, rank of a matrix, determinants, inverse of matrix, Gauss elimination and Gauss Jordan Methods, E-row methods. Caley Hamilton theorem, Eigen value & eigen vector.

Unit – 2	**Number of lectures = 10**	Laplace Transforms & application

Laplace transform & inverse Laplace transform: Solution based on Definition, change of scale property, 1st & 2nd shifting Theorem, LT division by t, LTof the dericative, LT by multiplication by t, Convolution th. And application on LT & Inverse LT.

Unit – 3	**Number of lectures = 10**	Calculus

Taylor & Maclaurin series for one and two variables (without proof), Partial derivative, Multiple integral: change of order of integration, Double integration in Cartesian & polar form. Triple integration & Beta and Gamma function.

Unit – 4	**Number of lectures = 12**	Differential equation & ita application

Exact differentia equation, Application of DE of first order and first degree to simple electric circuits, Linear differential equation of 2nd and higher order., Method of variation, Cauchy's and Lagrendre's linear equations, Application of linear differential equations to electric circuits.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

13. Books Recommended

Text Books

- N. P. Bali and Manish Goyal, A text book of engineering mathematics, Laxmi publication, 2010

14. Reference Books

- H.K.Dass, A text book of engineering mathematics, S.Chand & Company LTD
- B.S.Grewal, A text book of engineering mathematics, Khanna publication.
- Elements of Engineering Mathematics, Liu, Tata Mac Graw Hills.
- Kolman B, Busby R.C. and Ross S., Engineering Mathematical Structures for Computer Science, Fifth Edition, Prentice Hall of India, New Delhi, 2006.

1. Name of the Department- Civil Engineering						
2. Course Name	**Design Thinking**	**L**	**T**		**P**	
3. Course Code		**3**	**0**		**0**	
4. Type of Course (use tick mark)		**Core ()**	**PE ()**	**BSC ()**	**OE ()**	**EAS (✓)**
5. Pre-requisite (if any)	**NA**	**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 0**			

8. Course Description

Design thinking is a systematic method of solving problems. This method is unique that it starts and ends with humans. The design thinkers start by observing, interviewing or just plain experiencing a situation. Then, they proceed to improve the situation of the humans by solving problems for them. This course familiarizes you with the concept of "innovation" and the journey of a design idea from the identification of a problem to a final solution that has a positive impact on a large community of users.

10. Learning Objectives:

- **i)** To expose the student with state-of-the-art perspectives, ideas, concepts, and solutions related to the design and execution of innovation driven projects using design thinking principles.
- **ii)** To develop an advance innovation and growth mindset form of problem identification and reframing, foresight, hindsight and insight generation.
- **iii)** To prepare the mindset and discipline of systemic inspiration driven by an educated curiosity aimed find new sources of ideas, new connections and new models especially outside their regular operating atmosphere.
- **iv)** To propose a concrete, feasible, viable and relevant innovation project/challenge.

11. Course Outcomes (COs): The students will be able to: -

- **i)** Understand the concepts of design thinking approaches.
- **ii)** Create design thinking teams and conduct design thinking sessions.
- **iii)** Apply both critical thinking and design thinking in parallel to solve problems.
- **iv)** Apply some design thinking concepts to their daily work.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction to Design Thinking**

What Is Design Thinking? Preparing Your Mind for Innovation, Empathize Phase: Customer Journey Mapping, Analyze Phase: 5-Whys and How might we..., Idea Generation, Free Brainstorming & Make/Test Phase: Prototype, Experimentation.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Innovation by Design**

The Seven Concerns, Design Thinking and Collaboration, Challenges to Innovation, Understanding Users, Arriving at Design Insights, Prototyping for User Feedback, The First C: The Cause, Crossing the first Pitfall, Trial and Error, User Feedback for Development, New users, New needs to meet, Knowing the Context.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Context, Comprehension, Check and Cause**

The Second C: The Context, The Basic Need, Ingenious Attempt, Further Insights, The Working Rig, Concepts Generation, Experiencing the Product, Refinements.

The Third C: The Comprehension, Understanding Constraints, Positioning the Product, Exploring Possibilities, More Experiment, Understanding the Technology, At the 2nd Valley of Death, Finishing Touches.

The Fourth C: The Check and Cause, the product, the Users and the Context, The Prototyping, User Needs, The Crucial Step Missed.

Unit – 4	**Number of lectures = 12**	**Title of the unit: Conception, Crafting and Connection**

The Fifth C: The Conception, Synchronic Studies, One Product, many problems, Concept Clusters, From Idea to Product, Prototyping, Material and Technologies, Collaborative Efforts.

The Sixth C: The Crafting, Recap, The Manufacturing Challenge, The User Feedback, The Iterative Process.

The Seventh C: The Connection, The Seed for Innovation, Pinnacle for Innovation, The Innovation Timeline, The Innovation Champions, The Innovation Domain, The Innovation Template, The Serial Innovation.

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i) Innovation By Design by Chakravarthy, Battula Kalyana, and Janaki Krishnamoorthy, Springer India, 2013, ISBN 978-81-322-0901-0

Reference Books

i) Innovation by Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions by Thomas Lockwood, New Page Books, US; 1st edition (28 November 2017), ISBN: 1632651165.

ii) Innovation by Design by Gerard Gaynor, Amacom, A Division of American Management Associ135 West 50th Street New York, NY, United States, ISBN:978-0-8144-0696-0

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Basic Surveying**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus: Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

7. Learning objectives:

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

8. Subject Outcomes:

1. Prepare Topographical maps & surveyed site plans for civil projects.
2. They will be able to transfer map/drawing/layout plan on the actual site of civil projects.
3. Carry out tachometry, geodetic surveying wherever situation demands.
4. Apply error adjustment to the recorded reading to get an accurate surveying output.

9. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Plane Surveying and Levelling**

Introduction to plane surveying, conventional tape measurements, electronic distance measurement, Compass surveying, Fore and Back bearing, true and magnetic bearing, magnetic dip and declination, local attraction. Use of Dumpy level, Tilting level and Auto level. Temporary and Permanent adjustment of Dumpy level. Differential levelling, Longitudinal & Cross sectional levelling, refraction & curvature correction, Reciprocal levelling

Unit - 2	**Number of lectures = 10**	**Title of the unit: Theodolite and Contouring**

Theodolites– Temporary and Permanent adjustments, horizontal and vertical angle measurements, measurement of magnetic bearing. Electronic total station- Introduction and determination.
Contouring, basics of, characteristics of contours, contour gradient, plotting and use of contours.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Plane Table surveying**

Introduction, different methods of plane table surveying, two and three point problems as well as mechanical and graphical method for orientation of plane table .Adjustment of closed traverse.

Unit - 4	**Number of lectures = 12**	**Title of the unit: Triangulation& Geodetic Surveying**

Triangulation, Figure of triangulation, indivisibility height of station and signals. Base line measurement and correction .Trigonometrically leveling- Simple cases of height and distance. Geodetic observations- Correction of curvature and refraction, Axis signal correction. Determination of difference in level.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Punmia B.C, Surveying (2011), Volume 1, 2, 3 Sixteenth edition, ISBN No. 81-7008-853-4, Laxmi Publications.

Reference books

1. Subramanian R, Surveying and Levelling, Publication Oxford University Press.
2. Kanetkar T.P, Surveying and Levelling, Vol I, Pune.
3. Kanetkar T.P, Surveying and Levelling, Vol II, Pune.

1. Name of the Department –CIVIL ENGINEERING						
2. Subject Name	Engineering Mechanics	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials =0**	**Practical =0**			

7. Brief Syllabus

Introduction to Engineering Mechanics
Friction
Basic Structural Analysis
Centroid and Centre of Gravity.

8. Learning objectives:

1. Confidently tackle equilibrium equations, moments and inertia problems
2. Master calculator/computing basic skills to use to advantage in solving mechanics problems.
3. Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering

9. Subject Outcomes (COs):

1. Confidently tackle equilibrium equations, moments and inertia problems
2. Master calculator/computing basic skills to use to advantage in solving mechanics problems.
3. Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Introduction to Engineering Mechanics**

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy Kinematics, Statics, Equations of Motion.

Unit – 2	**Number of lectures = 10**	**Friction**

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

Unit – 3	**Number of lectures = 10**	**Basic Structural Analysis**

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Zero force members; Beams & types of beams; Frames & Machines.

Unit – 4	**Number of lectures =**	**Centroid and Centre of Gravity**

	12	

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text books:

1 Er. R.K Rajput (2011),ISBN No. 81/219/2594/0 Engineering Mechanics, 7th Edition, S Chand publications.

Reference Books:

1 F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.

2 R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

3 Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press.

1. Name of the Department: Civil Engineering						
2. Course Name	Basics of Materials	L	T		P	
3. Course Code		3	0		2	
4. Type of Course (use tick mark)		Core (✓)	PE ()		OE ()	
5. Pre-requisite (if any)	Students should have basic knowledge of chemistry at pre university level.	**6.** Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

8. Brief Syllabus

The objective of this course is to uncover the basics about the materials, in addition to focusing on the advance materials. This will inculcate the better understating about corrosion and polymer materials. Beside this, water chemistry will be part and parcel of this syllabus, to study remedial measures and its impact on materials. Moreover, this will decipher the basics of nano-materials, its applications in wide domains, with nano-toxicology and Safety Measures. This syllabus will enhance the outlook of the students toward materials and their advancements technologies.

9. Learning objectives:

This subject is taught to impart knowledge in the area of Materials:

1. To impart the basic knowledge of Materials from the atomic to molecular levels, which makes the student to understand the technology based on them.
3. To acquire the knowledge of corrosion and water treatment systems, which are essential for the Engineers and in industry.
4. To acquire the skills pertaining to nano-materials synthesis and to apply them for medical and other fields.
5. To impart the knowledge of polymers aspects useful for understanding the foundation of structures.
6. To bring adaptability to the concepts of Advance Materials and to acquire the required skills to become a perfect engineer.

10. Course Outcomes (COs):

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

CO1: Analyze solid structural system and apply in determination of various related various properties.

CO2: Apply and relate the principles and concepts of corrosion phenomenon.

CO3: Apply the understanding of nano-materials in the domains of life.

CO4: Understand the synthesis and applications of polymer science in construction technology.

CO5: Analyze the different prospects of advance materials and explain the problems caused by hard water in the industry and its treatment methods.

11. Unit-wise Detailed Content

Unit-1	**Number of lectures-8**	**Title of the unit: Solid State & Corrosion Engineering**

Basics of Solid-State Materials: Interactive Forces (Van der Waal's) and its types, Band Structure of

Solids and Effect of doping on Conductance. Type of Semiconductors: Intrinsic & Extrinsic, Radius Ratio rule, Type of Unit Cells and Bragg's Law, Graphite structural dynamics and conducting properties. Fullerene, its types and applications.

Corrosion Science: Introduction and Types of corrosion (Dry and Wet corrosion), Factors influencing corrosion, Type of Electrochemical corrosion, Protective measures against corrosion.

Unit - 2	**Number of lectures-12**	**Title of the unit: Nanomaterials, Types & Applications**

Introduction to Nanomaterials, Classification of Nanomaterials, Synthesis Methodology of Nano-Materials (Solution combustion, Sol-Gel, CVD and PVD Methods), Physico-Chemical Properties of Nano-Materials, Metallic Nanomaterials, Fullerenes and CNT's, Size Dependent Properties (Surface area, Optical, and Catalytic properties), Applications, Nano-toxicology and Safety Measures.

Unit - 3	**Number of lectures-12**	**Title of the unit: Basics of Polymers and Applications**

Introduction to Polymers, Classifications of Polymers, Mechanism of Polymerization, Physical, Thermal and Mechanical Properties of Polymers. Thermoplastic & Thermosetting polymers. Applications of Polymers in Building and Construction, Plastics & Plasticizers.

Unit - 4	**Number of lectures-10**	**Title of the unit: Science of Advanced Materials & Water Treatment Processes**

Introduction to Smart, Thermo chromic, Luminescent, Photo chromic, Piezoelectric, Ferroelectric, Self-Cleaning, Superconductors, Multifunctional, Biological and Moving Materials.

Hardness of water-Introduction. Causes of Hardness. Types of hardness: Temporary and Permanent. Units of hardness. Method of water softening (Lime Soda & Zeolite process). Disinfection of water by chlorination and Ozonization. Desalination of water-Reverse osmosis. Impact of Hard water on Materials. Exposure to applications based on current industrial trends.

11. Books Recommended (3 Text Books + 2 Reference Books)

i) Solid State Chemistry and its Applications, Wiley; 2nd edition (28 February 2014), by Anthony R. West.

ii) Nanostructures and Nanomaterials: Synthesis, Properties and Applications, World Scientific Publishing Company; 2nd edition (4 January 2011), by Cao

iii) Introduction to Polymer Chemistry, CRC Press; 1st edition (15 August 2006), by Charles E. Carraher Jr.

iv) Engineering Chemistry, Oxford University Press; First edition (1 May 2019), by Payal B. Joshi

v) Textbook of Engineering Chemistry, S Chand; New edition (31 July 2004), by SS Dara

1. Name of the Department: Civil Engineering Department						
2. Course Name	Materials Lab	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core (✓)	**PE()**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (✓)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward synthesis polymeric materials. In addition to that, this course will inculcate the understanding about parameters involved in the determination of water quality, in addition to its chemical properties.

8. Learning objectives:

1. Understand the synthetic methodology of polymeric materials.
2. To gain insight into basic concept of various chemical phenomenons involved in liquids.
3. Understand the parameter involved in determination of water quality.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved during the synthesis of polymeric materials of commercial use.
2. Apply the understanding of analytical techniques toward determination of water/ liquid quality.

8. Unit wise detailed content

1. To prepare the of urea-formaldehyde resin.
2. To prepare phenol-formaldehyde resin.
3. To prepare iodoform.
4. To determine the pH of a sample using digital pH meter.
5. To determine the total dissolved solids in a sample.
6. To determination the surface tension of a given liquid at room temperature using stalagmometer by drop number method.
7. To determine the viscosity of a given unknown liquid with respect to water at room temperature, by Ostwald's Viscometer.
8. Case Study: Water Quality Analysis of a given sample.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Basic Surveying Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

6. **Brief Syllabus:** Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

8. Learning objectives:

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

9. Subject Outcomes:

1. Prepare Topographical maps & surveyed site plans for civil projects.
2. They will be able to transfer map/drawing/layout plan on the actual site of civil projects.
3. Carry out tachometry, geodetic surveying wherever situation demands.
4. Apply error adjustment to the recorded reading to get an accurate surveying output.

10. Unit wise detailed content

Sr. No.	**Title**	**CO covered**
1.	Chain Survey by perpendicular offsets.	1
2	Compass Survey- Traversing using surveyor and prismatic compass.	1
3	Locating given building by chain and compass traversing	3
4	Theodolite Survey- Measurement of horizontal angles by method of repetition and reiteration.	2
5	Theodolite Survey- Measurement of Vertical angles by method of repetition and reiteration	
6	Measurement of Vertical Angles and determination of Height of an Object	2
7	Levelling- Rise &Fall method	1
8	Levelling- Height of collimation method	1

1. Name of the Department- Civil Engineering							
2. Course Name	**Workshop Technology Lab**	**L**		**T**		**P**	
3. Course Code		**0**		**0**		**2**	
4. Type of Course (use tick mark)		**Core ()**	**EAS (✓)**	**PE ()**		**OE ()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**		Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures = 0		**Tutorials = 0**		**Practical = 28**			
8. Course Description							

Workshop technology deals with different processes by which component of a machine or equipment's are made. The subject aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components and articles.

9. Learning objectives:

i. As the need of hand on practice for the engineers this course has special weight age.

ii. To be industry ready a student must have the knowledge of various welding processes, should have knowledge about the foundry and various machine tools. So this course fulfills all these needs.

10. Course Outcomes (COs): After the completion of the course, the student shall be able to

i.	Practice workshop safety rules effectively.
ii.	Acquire knowledge and use simple measuring and gauging instruments.
iii.	Acquire knowledge and use simple hand tools
iv.	Operate simple drilling machines for producing small holes
v.	Operate various machine tools for producing simple metal components and articles
vi.	Acquire knowledge and practice on foundry, forging, joints and welding

11. Lab Component

Sr. No.	**Title**	**CO covered**
1	To perform machining operations like turning, step turning, threading etc. on the Lathe.	v
2	To make slot on work piece by using Milling Machine.	iv
3	To prepare groves on work piece by using Shaper Machine.	v
4	To perform surface finishing operation on Surface Grinder.	iv, v
5	To perform drilling operations.	iv
6	To make cross lap joint.	iii, iv
7	To make butt joint	i, ii, vi
8	To make Lap joint by using Electric Arc Welding.	i, ii, vi
9	To make butt joint by using Electric Arc Welding	i, ii, vi

10	To practice fitting operations.	ii, iii, vi
11	To make male and female joint.	ii, iii, vi
12	To prepare open box tray.	ii, iii, vi

1. Name of the Department- Civil Engineering							
2. Course Name	**Engineering Graphics and design Lab**	**L**		**T**		**P**	
3. Course Code		0		0		2	
4. Type of Course (use tick mark)		**Core ()**	**EAS (✓)**	**PE ()**		**OE ()**	
5. Pre-requisite (if any)	**Geometry and Drawing at +2 Level**	**6. Frequency (use tick marks)**		Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures =0		**Tutorials = 0**		**Practical = 28**			
8. Course Description							

Engineering Graphics and design is considered as language of engineers. This course is introduced to provide basic understanding of importance of designing aspects in engineering applications. The topics are covered in a sequence and starts from the basic concepts of introduction to computer aided design and then designing of planes and solids. Towards the end of the course, it is expected that students would be matured to visualize the engineering components from any drawing sheet, followed by the projection techniques. A number of chosen problems will be solved to illustrate the concepts clearly.

9. Learning objectives:

i) To understand the basic concepts of Graphics.
ii) To develop the skills of reading & interpretation of Engineering Drawing.
iii) To construct the basic and intermediate geometry.
iv) To develop the skills of preparing the engineering drawing.

10. Course Outcomes (COs):

i) Understand the use of drawing instruments and dimensioning of given drawing.
ii) Acquire the visualization skills and use of projection methods.
iii) Able to draw the different views using projection of lines, planes and solids.
iv) Use of edges, vertices and curves to construct the drawing.

11. Lab component

Sr. No.	**Title**	**CO Covered**
1	Different types of lines with illustration and application.	I, II
2	Use of Drawing instruments and understands the design sheet layout with dimensioning and lettering.	I
3	Applications of drawing commands in AutoCAD.	I
4	Projection of points in all the four quadrants.	II
5	Projection of straight lines parallel, perpendicular, inclined to projection planes and traces of lines.	II, III
6	Projection of plane in perpendicular and inclined positions.	III

7	Projection of cones and solid cylinders with axes parallel, perpendicular and inclined to both the reference planes.	III, IV
8	Projection of prisms and pyramids with axes parallel, perpendicular, inclined to both the reference planes.	III, IV
10	Design Orthographic projection of simple machine elements and engineering drawings.	IV
11	Design Isometric projection of simple machine elements and engineering drawings.	IV
12	Design Sectional views of simple machine elements and engineering drawings.	IV

1. Name of the Department: Environment Science						
2. Course Name	Environment Science	**L (2)**	**T (0)**		**P (0)**	
3. Course Code						
4. Type of Course (use tick mark)		**Core ()**	**EAS(✓)**		**BSE ()**	
5. Pre-requisite (if any)	Basic Knowledge of Environment	**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical-(assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials = 0**	**Practical = 0**			

8. Brief Syllabus

The course intends to introduce students the objective of environmental sciences and the importance of conservation of natural resources. The students will learn about the sources, effects and control measures of air, water, soil, noise, thermal pollution. They will also be made aware of global environmental issues. The students will understand the need of sustainable development, environment pacts, role of information technology in the environment. The students will be explained basic principles of green building and environmental remedial measures.

9. Learning objectives:

- To develop awareness about our environmental scenarios.
- To develop a concern about sustainable development through future strategies.

10. Course Outcomes (COs)

On completion of this course, the student should be able to:

- Understand about environment and its components and Problems associated with natural resources and their sustainable use.
- Sources of pollution in air, water and soil and Solid waste management and natural Disaster management.
- Understanding about environmental and social issues, ecosystems, biodiversity.
- Understanding of role of information technology to address environmental issues through human involvement.

11. Unit-wise Detailed Content

Unit-1	**Number of lectures=6**	**Title of the unit: Multi-disciplinary Approaches and Environmental Pollution and Control Technologies**

Introduction and Components of the Environment, Factors leading to Environment Degradation. Environmental Pollution; Air Pollution, Water pollution and Noise Pollution. Solid waste (E-wastes): Sources, and Remedial Measures.

Unit - 2	**Number of lectures=6**	**Title of the unit: Natural Resources**

Natural Resources: Renewable and Non-Renewable resources; Water resources: use and Over utilization of surface and ground water, Role of Dams. Changes in agricultural ways: Water logging, Salinity; Mineral Resources: Use and Over-exploitation; Land resources: Man induces Landslides, Soil Erosion, and Desertification; Energy resources: Use of Alternate Energy Sources.

Unit - 3	**Number of lectures=8**	**Title of the unit: Eco-Systems and its Characteristics**

Ecosystem: Classification, Structure, and Function of an ecosystem, Food Chains, Food Webs, and Ecological Pyramids. Biogeochemical cycles, Bio magnification, Introduction and characteristic features of the following Eco-systems: Forest ecosystem, Desert ecosystem, Aquatic Eco-systems.

Unit - 4	**Number of lectures=8**	**Title of the unit: Bio-diversity and Global Environmental Issues**

Definition, Genetic, Species and Ecosystem diversity. Threats to biodiversity: habitat loss, poaching of wildlife, impact of mankind on wildlife; conservation of biodiversity: In-Situ and Ex-situ conservation. Global Environmental Issues: Ozone depletion and Ozone depleting substances (ODS). Deforestation and Desertification, Acid Rain and Global Warming. Concept of Green Building. Legal Aspects Air Act, Water Act, Forest Act, Wild life Act.

12. Brief Description of self-learning / E-learning component

E-Learning, the online platform, will involve the NPTEL and SWAYAM portal system for the holistic knowledge. Power Point Presentation will be used. Online Lecture series will be beneficial for the students. Online assignment will be designated to students at large. Seminars will be conducted for the broad-spectrum knowledge.

13. Books Recommended (1Text Books + 5 Reference Books)

TEXT BOOKS:

- Environmental Studies, Anindita Basak, Pearson Education, 2009.

REFERENCE BOOKS:

- Tata McGraw Hill Education Private Limited, 2007.
- Environmental Studies, Suresh K. Dhameja, S.K. Kataria and Sons, 2008.
- Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
- Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.

2nd Semester

1. Name of the Department: B.Tech (1st Year)						
2. Course Name	Applied Physics	**L** **3**	**T** **0**		**P** **0**	
3. Course Code						
4. Type of Course (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Physics at +2 Level	**6. Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 00**			

8. Brief Syllabus

Engineering physics course provide an opportunity to students to learn fundamental concepts of physics and apply these concepts in today's rapidly changing and highly technical/engineering environment. This course also emphasizes the solid foundations of modern scientific principles.

9. Learning objectives:

- To give students a basic exposure to Physics that will better prepare them for more rigorous courses that will be taken later on.
- To make students learn and understand basic concepts and principles of physics to analyze practical engineering problems and apply its solutions effectively and meaningfully.

10. Course Outcomes (COs):

At the completion of this course, students will be able to:

- Describe the behavior of and make predictions regarding the phenomena of the physical world.
- Apply fundamental principles of physics to solve problems relating to mechanics, energy, matter, and waves.
- Understand the importance of record-keeping and have practiced its use during labs and/or lectures.

11. Unit wise detailed content

Unit-1	**Number of lectures = 11**	**Title of the unit: Interference and Diffraction**

Interference: Coherent sources, conditions for sustained interference. Division of Wave-Front - Fresnel's Biprism, Division of Amplitude- Wedge-shaped film, Newton's Rings, Michelson Interferometer, applications (Resolution of closely spaced spectral lines, determination of wavelengths, determination of refractive indices of the medium).

Diffraction: Difference between interference and diffraction, Fraunhofer and Fresnel diffraction. Fraunhofer diffraction through a single slit, Plane transmission diffraction grating, absent spectra, Rayleigh criterion of resolution, dispersive power and resolving power of grating.

Unit - 2	Number of lectures = 10	Title of the unit: Polarization and Special Theory of Relativity

Polarization: Polarized and unpolarised light, uniaxial crystal, double refraction, Nicol prism, Quarter and Half wave plates, Detection and production of different types of polarized light, polarimetery, optical and specific rotation, Biquartz & Laurent's half shade polarimeter.

Special Theory of Relativity: Michelson's Morley Experiment Postulates of special theory of relativity, Lorentz transformations. Consequences of LT (length contraction and time dilation). Addition of velocities, variation of mass with velocity, Mass energy equivalence.

Unit - 3	Number of lectures = 10	Title of the unit: Laser and Fiber Optics

LASER: Spontaneous and Stimulated emission, Laser action, characteristics of laser beam-concept of coherence, spatial and temporal coherence, He-Ne, Ruby Laser and semiconductor lasers (simple ideas), applications.

Fiber Optics: Propagation of light in optical fibers, numerical aperture, V-number, single and multimode fibers, attenuation, dispersion, applications.

Unit - 4	Number of lectures = 11	Title of the unit: Dielectrics and Superconductivity

Dielectrics: Molecular theory, polarization, displacement vector, electric**,** Susceptibility, dielectric coefficient, permittivity & various relations between these, Gauss's law in the presence of a dielectric, Energy stored in a uniform electric field, concept of local molecular fields and Classius- Mossotti relation.

Superconductivity: Introduction (Experimental survey), Meissner effect, London equations, Hard and Soft superconductors, Elements of BCS Theory.

12. Brief Description of self-learning / E-learning component

To understand basic concepts in detail, students may get study materials on following links.

https://onlinecourses.nptel.ac.in/noc18_ph02

https://ocw.mit.edu/courses/physics/

13. Books Recommended (3 Text Books + 2-3 Reference Books)

TEXT BOOKS:

- Modern Physics for Engineers – S.P.Taneja (R. Chand)
- Engineering Physics – SatyaPrakash (Pragati Prakashan)
- Modern Engineering Physics – A.S.Vasudeva (S. Chand)

REFERENCE BOOKS:

- Perspectives of Modern Physics - Arthur Beiser (TMH)
- Optics – Ajoy Ghatak (TMH)
- Fundamentals of Physics – Resnick & Halliday (Asian Book)
- Introduction to Electrodynamics – D.J. Griffith (Prentice Hall).

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Advanced Surveying**	**L**	**T**		**P**	
3. Subject Code		2	0		0	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	**Frequency (use tick marks)**	Even (✓)	Odd ()	**Frequency (use tick marks)**	Even ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials = 00**	**Practical =00**			

Brief Syllabus: Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

12. Learning objectives:

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

13. Subject Outcomes:

1. Prepare Topographical maps & surveyed site plans for civil projects.
2. They will be able to transfer map/drawing/layout plan on the actual site of civil projects.
3. Carry out tachometry, geodetic surveying wherever situation demands.
4. Apply error adjustment to the recorded reading to get an accurate surveying output.

10. Unit wise detailed content

Unit-1	**Number of lectures = 7**	**Title of the unit: Curves:**

Introduction, theory and setting out methods of simple circular curve, elements of a compound and reverse curves, transition curve, types of transition curve, combined curve, types of vertical curves.

Unit - 2	**Number of lectures = 7**	**Title of the unit: Global Positioning System**

Maps & their numbering, Map projection and co-ordinate system, Geo referencing and datums, Basic concepts of GPS

Unit - 3	**Number of lectures = 7**	**Title of the unit: Geographical Information System & Remote Sensing**

Introduction, Definitions, Basic Concepts, history and evolution, Components, Need, Scope, interdisciplinary relations, applications areas, and overview of GIS. GIS data: spatial and non-spatial, spatial data model: raster, vector,

Physics of remote sensing, Characteristics of electro-magnetic radiation; Interactions between matter and electro-magnetic radiation; energy interaction in the atmosphere; energy interactions with the

earth's surface spectral reflectance curves. Types of remote sensing

Unit - 4	Number of lectures = 7	Title of the unit: Arial Photogrammetry

Definition and terms, history of Photogrammetry, concepts, principles and types of Photogrammetry, types of aerial photographs vertical photographs, tilted photographs, aerial cameras, displacements and their corrections.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. 1. Punmia B.C, Surveying (2011), Volume 1, 2, 3 Sixteenth edition, ISBN No. 81-7008-853-4, Laxmi Publications.

Reference books

1. Subramanian R, Surveying and Levelling, Publication Oxford University Press.
2. Kanetkar T.P, Surveying and Levelling, Vol I, Pune.
3. Kanetkar T.P, Surveying and Levelling, Vol II, Pune

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Building construction and materials**	**L**	**T**		**P**	
3. Subject Code		2	0		0	
4. Type of Subject (use tick mark)		**HSMC&CRC (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including public works such as roads, bridges, canals, dams, airports, sewerage systems, pipelines, structural components of buildings, and railways.

8. Learning objectives:

1. To teach students about the physical and mechanical properties of various construction materials and their testing procedure.
2. To teach students about the principles and methods to be followed in constructing various components of a building.
3. To make the students aware of precautionary measures to be taken during construction to avoid any damage to the structure at a later date.
4. To teach students about assessment of damages and methods of repairs and restoration.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Follow BIS and NBO codes for different components of building construction along with testing procedure of building materials with respect to relevant codes.
2. Supervise construction work with technical ability within the frame work of codal provision.
3. Select the modern construction materials appropriate to the climate and functional aspects of the buildings.
4. Supervise the construction technique to be followed in brick and stone masonry, concreting, flooring, roofing and plastering etc.
5. Understand the common lapses during the construction which results in the deterioration/damage to the structure at the later date.
6. Study the causes of deterioration, crack pattern and assessment of damage to the structure due to faulty construction or natural calamity.
7. Construction techniques in repairing and rehabilitation of structures

10. Unit wise detailed content

Unit-1	**Number of lectures = 07**	**Title of the unit: Properties of materials and Miscellaneous Materials**

Physical and Mechanical properties of construction materials – stones, brick, cement, aggregate, timber, tiles. Testing of said materials as per BIS specifications

Structural Steel and Aluminum, Roofing Material, Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials, Timber and its Products, Modern materials, Neoprene, thermocol, vinyl flooring, decorative panels and laminates, anodized aluminum, architectural glass and ceramics.

Unit - 2	**Number of lectures = 07**	**Title of the unit: Brick & Stone Masonry, Foundations**

Brick masonry construction- Principles of construction, types of bonds, introduction to reinforced brick work, lintels and arches.
Stone masonry – Types of stone masonry & method of its construction, lintels and arches.
Finishing- Pointing, Plastering, Paintings, varnishing.
General Principles of – Flooring and its types, Roofing and its types, Damp proof course (DPC).
Function of foundation, Types of foundation- Shallow and deep foundation

Unit - 3	**Number of lectures = 07**	**Title of the unit: Thermal Insulation and Acoustic**

Thermal insulation- Types of materials, Heat transfer and basic definition, methods of thermal insulations for roof, exposed walls, doors and windows in building construction.
Acoustics- Types of materials for improvement of acoustics in building construction, audible sound, behavior of sound, reflection of sound, reverberation and absorption, sound insulation and acoustic design of hall.

Unit - 4	**Number of lectures = 07**	**Title of the unit : Repair, Rehabilitation**

Preventive measures during construction for a durable and safe building structures, assessment of damage due to faulty construction and natural and manmade calamities, repair and rehabilitation of structures using Polymer concrete, Sulphur infiltrated concrete, Fiber reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Rangawala , Building Construction (2010) ISBN No. 978-93-80358-15-4,Charotar Publications Pvt. Ltd. 28th Edition

Reference books

1. P.C.Varghese, Engineering Materials, 1st edition, PHI Learning.
2. S.K.Duggal, Building Materials, 3rd Edition, New Age International Publishers.
3. Sushil Kumar, Building Construction, Standard Publishers Distributors.
4. M.S.Shetty, Concrete Technology: Theory and Practice, S. Chand Publishers.
5. A.R.Santhakumar, Concrete Technology, Oxford University Press.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Concrete Technology**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Introduction to Civil Engineering	**Frequency (use tick marks)**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 33		**Tutorials = 00**	**Practical = 00**			

7. Brief Syllabus: Concrete is one of the most vital materials used in construction. Concrete is made up of cement, coarse aggregate; fine aggregate, water and admixtures. The strength of concrete is directly depends upon the properties of these materials and their proportion in the concrete. In this course students will learn the various properties of concrete ingredients and various properties of concrete itself and their testing including non-destructive testing such as ultrasonic pulse velocity test, rebound hammer test etc. They will also learn the various mix design methods to design the concrete for different construction works.

8. Learning objectives:

1. To understand the properties of ingredients of concrete.
2. To study the behavior of concrete at its fresh and hardened state.
3. To study about the concrete design mix.
4. To know about the procedures in concrete at different stage.
5. To understand special concrete and their uses.

9. Subject Outcomes: On completion of this course, the students will be able to

1. To identify suitable materials to be used in the cement concrete by conducting various tests as per BIS code.
2. Test all the concrete materials as per BIS code.
3. Design the concrete mix using ACI and BIS code methods.
4. Determine the properties of fresh and hardened of concrete.
5. Design special concretes and their specific applications and use of admixtures.
6. Ensure quality control while testing/ sampling and acceptance criteria for pre and post construction work.
7. Use of non-destructive testing equipment.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Concrete materials, Cement: Field and laboratory tests on cement, Types of cement and their uses, different tests for aggregates. Methods for manufacturing of cement- Wet and dry process. Hydration of cement, Bogue's compound

Unit - 2	**Number of lectures = 10**	**Title of the unit: Admixtures**

Accelerating admixtures, Retarding admixtures, water reducing admixtures, Air entraining

admixtures, coloring agent, Plasticizers. Batching, Mixing, Transportation, Placing of concrete, curing of Concrete

Unit – 3	**Number of lectures = 10**	**Title of the unit: Behavior of Concrete**

Strength of concrete, Shrinkage and temperature effects, creep of concrete, permeability of concrete, durability of concrete, Corrosion, Causes and effects, remedial measures, Thermal properties of concrete, Micro cracking of concrete.

Unit – 4	**Number of lectures = 12**	**Title of the unit: Mix Design and Special Concrete**

Factors influencing mix proportion, Mix design by ACI method and I.S. code method, Design of high strength concrete.

Light-weight concrete, Fibre reinforced concrete, Polymer modified concrete, Ferro cement, Mass concrete, Ready-mix concrete, Self-compacting concrete, Quality control, Sampling and testing, Acceptance criteria.

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. Gambhir, M.L., Concrete Technology (2012) ISBN No. 978-00-07-015133, 9th Edition, Tata McGraw Hill.

Reference books:-

1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co.
2. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi**.**
3. Nevile, Properties of Concrete, Longman Publishers.

1. Name of the Department: Civil Engineering						
2. Course Name	Elements of Environmental Engineering	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core (✓)	PE ()		OE ()	
5. Pre-requisite (if any)	Students should have basic knowledge of Environmental Science	**6.** Frequency (use tick marks)	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 00**			

8. Brief Syllabus

This objective of the Elements of Environmental Engineering is to acclimatize the learner about the ecosystem, biodiversity and conservation strategies. In addition to that, emphasis will be on deciphering the chemical processes and energy management skills. Moreover, learner will grasp knowledge about basics causes of the wastewaters and solid wastes, an environmental issue, with proper disposal systems. At the end, global issue will be curtailed and exposed to legal actions for the same.

9. Learning objectives:

1. To study the fundamental of Ecosytem, Biodiversity and conservation techinques.
2. To study the different chemical phenomenon & conceptual energy management.
3. To understand basic analytics of wastewater, solid waste and advanced spectroscopic techniques.
4. To understand the existing environmental issue and various legal action.

10. Course Outcomes (COs):

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

CO1: Able to aware and establish conservation methodologies for endangered flora/fauna of the ecosystem.

CO2: Apply the concepts of chemical Processes in various domains of life.

CO3: Apply the energy management and monitoring techniques in analytical activities.

CO4: Manage and report environmental quality data in a way that is meaningful and understandable to intended audience

CO5: Understand the global environmental issues from different areas & able to apply remedial measures as well.

11. Unit-wise Detailed Content

Unit-1	**Number of lectures-10**	**Title of the unit: Basics of Ecosytem, Biodiversity and Conservation Strategies**

Ecosystem: Classification (Natural & Artificial), Structure, and Function of an Ecosystem, Food Chains, Food Webs, and Ecological Pyramids. Biogeochemical cycles, Biomagnifications, Mortality and Survivorship, Biological Metabolism.

Introduction: Genetic, Species and Ecosystem diversity. Threats to Biodiversity, Impact of Mankind on Wildlife; Conservation Strategies: In-Situ and Ex-situ.

Unit - 2	**Number of lectures-12**	**Title of the unit: Chemical Processes & Energy Management**

Introduction to Chemical Reactions-Endothermic & Exothermic, Chemical Equilibrium. Reaction rates, Order, Molecularity. Catalysis-Homogenous and Heterogeneous concepts and applications.

Definition and Objective of Energy Management, First & Second law of Efficiency, Energy Flow Balance diagram, Energy Balance sheet and Management Information System (MIS), Energy Audit Instruments. Energy Monitoring and Savings Techniques.

Unit - 3	**Number of lectures-12**	**Title of the unit: Analytics of Wastewater, Solid Waste and Advanced Analytical Methods**

Objectives of Water and Wastewater treatment, Characteristics of wastewater and Disposal systems of Waste Water. Definition, identification of Hazardous Solid wastes-sources, Characteristics, and Disposal systems. BOD & COD.

Working principles of Spectrophotometric methods; Nephelometric methods; Atomic Absorption spectroscopy, Ion chromatography, High performance liquid chromatography, CHNO/S Analyzer, Mass Spectroscopy.

Unit - 4	**Number of lectures-8**	**Title of the unit: Global Environmental Issues & Remedial Measures**

Introduction to Climate Change and Global Warming, International Response to Climate Change & Global Warming, Ozone depletion and Ozone depleting substances (ODS). Deforestation and Desertification, Acid Rain and its impact.

Concept of Green Building and Legal Aspects: Air Act, Water Act, Forest Act, Wild life Act. Kyoto & Montreal Protocol. Exposure to applications based on current industrial trends.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Fundamentals of Ecology, Cengage; 5th edition (15 November 2017), by Eugene Odum

2. Environmental Quality, Monitoring and Management, Callisto Reference (20 June 2019), by Meghan Higgins

3. Environment and Ecology, Dreamtech Press (25 June 2020); Dreamtech Press, by Anuj Kumar Purwar

4. Design of Water Quality Monitoring Systems, Wiley; 1st edition (1 December 1990), by Robert C. Ward, Jim C. Loftis, Graham B. McBride

5. Environmental Law and Policy in India: Cases, Material & Statutes, Oxford; Edition (1 February 2002), by Divan Shyam

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Advanced Surveying Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

1. **Brief Syllabus:** Surveying is the most useful and necessary part in Civil Engineering. Students will understand the use of Chains, Tapes, Compass, as well as optical surveying instruments such as Theodolite, Total Stations, Auto Levels and Electronic distance measuring machines. Students will also understand reduction of slope measurements to horizontal and vertical components, field data reduction and adjustment of a closed traverse.

8. Learning objectives:

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

9. Subject Outcomes:

1. Prepare Topographical maps & surveyed site plans for civil projects.
2. They will be able to transfer map/drawing/layout plan on the actual site of civil projects.
3. Carry out tachometry, geodetic surveying wherever situation demands.
4. Apply error adjustment to the recorded reading to get an accurate surveying output.

10. Unit wise detailed content

Sr. No.	**Title**	**CO covered**
1.	Study of aerial photogrammetric	1
2	Study of GIS data: spatial and non-spatial	1
3	Plane Table Survey- Radiation, Intersection, Traversing methods	3
4	Plane Table Survey- Two and three point problem (Lehman's method).	2
5	Study and setting out methods of simple circular curve	4
6	Tacheometric survey- Determination of additive and multiplication constant, determination of horizontal distance and RL.	2
7	Contouring- To determine the contours for a given location.	1
8	Demonstration of Total station	1

1. Name of the Department: Civil Engineering						
2. Course Name	Environment Analysis Lab	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core (✓)	**PE ()**		**OE ()**	
5. Pre-requisite (if any)		Odd ()	Even (✓)	Odd ()	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward environment system. In addition to that, this course will inculcate the understanding about parameters involved in the determination of environment conditions.

8. Learning objectives:

1. Understand the processes for determination of environment variables.
2. To gain insight into basic concept of environment systems.
3. Understand the parameter involved in determination of environment variables.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of water quality variables.
2. Apply the understanding of analytical techniques toward parameters that waste management processes.

8. Unit wise detailed content

1. To measure of BOD of a water sample.
2. To analysis of the COD of a water sample.
3. To determine the alkalinity in water sample.
4. To determine the acidity in water sample.
5. To estimate the Chloride content in water sample.
6. Determination of Phosphates and Sulphates.
7. Determination of Optimum Coagulant dosage
8. Determination of Iron and Fluoride
9. Determination of Oil and Grease
10. Determination of suspended, settleable, volatile and fixed solids.

1. Name of the Department: Civil Engineering						
2. Course Name	Building Construction and materials Lab	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core (✓)	**PE ()**		**OE ()**	
5. Pre-requisite (if any)		Odd ()	Even (✓)	Odd ()	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including public works such as roads, bridges, canals, dams, airports, sewerage systems, pipelines, structural components of buildings, and railways.

8. Learning objectives:

1. To understand the regulations as per National Building Code To analyse the structures.
2. To identify the functional requirements and building rules.
3. To understand the sketches and working drawings.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Implement the regulations for layout planning and preparation of drawings.
2. Prepare building drawings for residential building and hospital buildings.
3. Design the different projections of the buildings

7. Unit wise detailed content

Detailed Drawings (Plan, Elevation and section for the following:-

1) Simple residential and industrial buildings with fl at and pitched roof.

2) Dispensary – Provision for Handicapped people

3) Workshop – Trussed roof.

4) Terminal buildings for multi-modal systems

5) Detailed drawings for doors, windows, rolling shutters and collapsible gates.

6) Introduction to reinforced concrete drawings and structural steel drawings

7) Planning, design and detailed drawings of staircase.

1. Name of the Department- Civil Engineering						
2. Course Name	**Biology for Engineers**	**L**	**T**		**P**	
3. Course Code		**2**	**0**		**0**	
4. Type of Course (use tick mark)		**Core ()**	**PE ()**	**BSC (✓)**	**OE ()**	**EAS ()**
5. Pre-requisite (if any)	**NA**	**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 28	**Tutorials = 0**	**Practical = 0**

8. Course Description

It is well known that this is the century of biology in which significant advances in the understanding and application of biological systems are expected. The significant impact on the world is expected in terms of better healthcare, better processes, better products and an overall better quality of life. Thus, any person can be interested in knowing the fundamentals of biology to be able to understand, or participate in the biological revolution. For example, any engineer, irrespective of the parent discipline (mechanical, electrical, civil, chemical, metallurgical, etc.,) has a high probability of using the disciplinary skills toward designing/improving biological systems in the future. This course is designed to convey the essentials of cell and molecular biology to provide a frame-work for more specific understanding, and contribution by any interested person.

9. Learning Objectives:

- **i)** To understand biological concepts from an engineering perspective.
- **ii)** To understand the inter-connection between biology and future technologies.
- **iii)** To motivate technology application for biological and life science challenges.
- **iv)** To understand the Physiological Assist Device.

10. Course Outcomes (COs): The students will be able to: -

- **i)** Understand the biological concepts from an engineering perspective
- **ii)** Understand the concepts of biological sensing and its challenges
- **iii)** Understand development of artificial systems mimicking human action
- **iv)** Integrate biological principles for developing next generation technologies

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Need to study Biology**

Life Science Studies Significance, Bio Inspired Inventions, Role of Biology in Next Generation Technology Development, Cell Structure, Cell Potential, Action Potential, ECG and other common signals – Sodium.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Nervous Systems**

Potassium channels, Neuron function, Central Nervous Systems, Evolution of Artificial Neural Networks, Machine Learning techniques.

Unit – 3	**Number of lectures = 11**	**Title of the unit: Sensing Techniques**

Understanding of Sense organs working, Sensing mechanisms, Sensor Development issues, Digital Camera, Eye Comparison, electronic nose, electronic tongue, electronic skin.

Unit – 4	**Number of lectures = 11**	**Title of the unit: Physiological Assist Device**

Physiological Assist Device: Artificial Organ Development: Kidney, Liver, Pancreas, heart valves – Design Challenges and Technological Developments

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

13. Books Recommended

Text Book

i)	Biology for Engineers by Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, ISBN: 1121439934

Reference Books

i)	Biology for Engineers by Wiley Editorial (Author), January 2018, ISBN: 8126576340.
ii)	Biology for Engineers by G. K. Suraish kumar, Oxford University Press; First edition, May 2019, ISBN: 0199498741

1. Name of the Department- Civil Engineering						
2. Course Name	**Object Oriented Programming Lab**	**L**	**T**		**P**	
3. Course Code		**0**	**0**		**2**	
4. Type of Course (use tick mark)		**Core (✓)**	**PE()**		**OE ()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even(✓)	Odd ()	Either Sem()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

8. Course Description

9. Learning objectives:

- To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc
- To have the ability to write a computer program to solve specified problems

10. Course Outcomes (COs):

- Understand the features of C++ supporting object oriented programming
- Understand the relative merits of C++ as an object oriented programming language
- Understand th features of C++ supporting object oriented programming
- Understand the relatives merits of C++ as an object oriented programming language

11. List of Experiments

1. Simple C++ programs to implement various control structures.

a. if statementb. switch case statement and do while loop

c. for loopd. while loop

2. Programs to understand structure &unions.

a. structure b. union

3. Programs to understand pointer arithmetic.

4. Functions &Recursion.

a. recursion b. function

5. Inline functions.

6. Programs to understand different function call mechanism.

a. call by reference b. call by value

7. Programs to understand storagespecifiers.

8. Constructors &destructors.

9. Use of –this pointer using class

10. Programs to implement inheritance and function overriding.

a. multiple inheritance –access Specifies

b. hierarchical inheritance – function overriding /virtual Function

11. Programs to overload unary & binary operators as member function &non member function.

a. unary operator as member function

b. binary operator as non member function

11. Programs to understand friend function & friend class.

13. Programs on class templates

14. Using a C++ program check whether a student passed the exam or not based on total mark which shall be above40%

12. Create a C++ program which takes two distances in inch-feet system and stores in data members of two structure variables. Then, this program calculates the sum of two distances and displays it.

12. Brief Description of self-learning / E-learning component

http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/index.php

1. Name of the Department- Management Studies							
2. Course Name	**Universal Human Values**	**L**		**T**		**P**	
3. Course Code		2		0		0	
4. Type of Course (use tick mark)		**Core ()**	**EAS ()**	**BSE (✓)**		**PE ()**	
5. Pre-requisite (if any)	Basic Knowledge of Human Values	**6. Frequency (use tick marks)**		Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)							
Lectures =28		**Tutorials = 0**		**Practical = 0**			

8. Brief Syllabus

Introduction to Value Education, Harmony in the Human Being, Harmony in the Family and Society and Harmony in the Nature, Social Ethics

9. Learning objectives:

The objective of this course is to:

- **i)** To assist students in understanding the differences between values and skills, and in understanding the need, basic guidelines, content and the process of value education.
- **ii)** To help students initiate a process of dialog within themselves to understand what they 'really want to be' in their lives and professions
- **iii)** To help students understand the meaning of happiness and prosperity for human beings.
- **iv)** To help students understand harmony at all the levels of human living and to lead an ethical life.

10. Course Outcomes (COs):

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationships based on trust and respect in their life and profession
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start identifying a strategy to actualize a harmonious environment wherever they work.

11. Unit wise detailed content

Unit-1	**Number of lectures = 7**	**Title of the unit: Introduction to Value Education**

Value Education, Definition, Concept and Need for Value Education, The Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education.

Unit – 2	**Number of lectures = 7**	**Title of the unit: Harmony in the Human Being**
Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.		
Unit – 3	**Number of lectures = 7**	**Title of the unit: Harmony in the Family and Society and Harmony in the Nature**
Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love, Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.		
Unit – 4	**Number of lectures = 7**	**Title of the unit: Social Ethics**
The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities.		

12. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/

Journal papers; Patents in the respective field.

13. Books Recommended

TEXT BOOKS

1. A.N Tripathy, New Age International Publishers.
2. Bajpai. B. L,, New Royal Book Co, Lucknow, Reprinted.
3.Bertrand Russell Human Society in Ethics & Politics

REFERENCE BOOKS

1.Corliss Lamont, Philosophy of Humanism
2. Gaur. R.R., Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books.
3. Gaur. R.R. , Sangal. R, Bagaria. G.P, Teachers Manual Excel Books.

3rd Semester

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Fluid Mechanics**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

7. Brief Syllabus

Fluid mechanics includes fluid statics and dynamics, conservation of mass, momentum, and energy in incompressible flow & flow of a real fluid--including laminar and turbulent flow, dimensional analysis and similitude & the applications to engineering problems.

8. Learning objectives:

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system for hydraulic structures.
2. Develop competence with mass, energy and momentum for determining resultant forces on hydraulic structures.
3. Study of boundary layers and calculation of drag force for practical hydraulic problems.

9. Subject Outcomes:

1. Calculate static and dynamic forces on hydraulic structures.
2. Determine pressure in a closed conduit carrying fluids.
3. Determine unknown factors with the help of dimensional analysis.
4. To calculate the drag forces on a body in a flowing fluid as well as drag forces on a moving body in the fluid with the concept of boundary layer theory.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Fluid Properties and Hydrostatics Pressure and its measurement**

Density, Viscosity, Surface tension, compressibility, capillarity, vapour pressure and cavitations. Hydrostatic forces on plane, inclined and curved surfaces submerged in a fluid.
Buoyancy - Centre of buoyancy & metacentric.
Fluid pressure at a point, Pascal's law, measurement of pressure- Manometer and Piezometer, Pressure at a point in incompressible fluid.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Fluid Kinematics**

Introduction to Laminar and Turbulent flow Fluid Kinematics - Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows. Continuity equation, streamline and velocity potential lines, Euler and Bernoulli's equations and their applications, moment equation, momentum and energy correction factors, Impulse Momentum equation, Navier-Stokes-Equations and its applications.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Flow through pipes and other fixtures**

Flow through orifice, mouth piece, notches and weirs. Discharge measurement- venturimeter, orifice meter, pitot tube. Flow through pipes i.e. Laminar, Transition and Turbulent flow.
Losses in pipes- Laws of fluid friction, Darcy's equation, Chezy's formula, Manning's formula and Hazen- William's formula. Major and minor losses. Pipe network.

Unit – 4	**Number of lectures = 12**	**Title of the unit: Boundary layers, Dimensional analysis**

Boundary layers, Laminar flow and Turbulent flow, Boundary layer thickness, displacement and momentum thickness, boundary layer separation Hydraulic Machines- Introduction to centrifugal and reciprocating pumps, turbines.
Dimensional homogeneity, Raleigh and Buckingham π theorems, Model laws; distorted and undistorted models. Similitude-Types of similarities. Types of forces acting on moving fluid and dimension less numbers.

Brief Description of self-learning / E-learning component
The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. R.K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines (2011), ISBN No. 978-81-318-0815-3 9th Publications, Laxmi Publication.

Reference Books

1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, Katson Publishing House.
2. V.L. Streeter, Fluid Mechanics, McGraw Hill Book Co.
3. K. Subramanian, Fluid Mechanics and hydraulic machines McGraw Hill Book Co.
4. P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications.

1. Name of the Department –CIVIL ENGINEERING						
2. Subject Name	**Strength of Materials**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (✓)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical =0**			

7. Brief Syllabus

This course introduces students to the basics of strength of materials. This includes: Properties of materials, Stresses and strains, Shear Force, Columns and Struts, Deflection of beams and failures theory and Bending Moment.

8. Learning objectives:

1. Confidently tackle equilibrium equations, moments and inertia problems
2. Master calculator/computing basic skills to use to advantage in solving mechanics problems.
3. Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering

9. Subject Outcomes : By the end of this course the student will be able to:

1. Identify different materials and their behaviour
2. Analyse various civil engineering structures under different loading conditions
3. Apply the principles of structural mechanics in design structural elements
4. Apply the concepts of failure theories for design of structures

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Properties of Materials**

Introduction ,Normal and Shear stresses, stress- Strain diagrams for ductile and brittle material ,Elastic constants, One Dimensional loading of members of varying cross sections

Compound stresses: General state of stress, resultant stress and strain, principal stresses and principal strains, Mohr's circle for compound stresses and strains.

Unit – 2	**Number of lectures = 11**	**Shear Force and Bending Moment & bending of beams**

Introduction ,shear force and bending moment ,Differential equations for equilibrium ,shear force and bending moment diagrams for statistically determinate beams

Introduction - Failure Criteria of beams - Theory of bending - Section modulus of rectangular and circular sections (Solid and Hollow) - deflection of beams by Macaulay's method - moment area method and conjugate beam method.

Unit – 3	**Number of lectures =10**	**Slope and deflection & Columns**

Relationship between moment, slope and deflection, Moment area method, Macaulay's method and conjugate beam method, Use of these methods to calculate slope and deflection for determinant beams.

Criteria for stability of columns, Buckling of columns, Euler's formula for various end restraints, Rankin's formula,

Unit – 4	**Number of lectures = 11**	**Torsion and Truss**

Torsion: Torsion: Introduction, Torsion shafts of circular section, torque and twist, Shear stress due to torque.

Truss: Introduction, Simple Truss and solution of simple truss, Method of joints and method of sections.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E- Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books:

1 Er. R.K Rajput (2011), ISBN No. 81/219/2594/0 Engineering Mechanics, 7th Edition, S Chand publications.

Reference Books:

2 F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.

3 R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

4 Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press.

5 Shames and Rao (2006), Engineering Mechanics, Pearson Education.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Fluid Mechanics Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 20**			

7. Brief Syllabus

Fluid mechanics includes fluid statics and dynamics, conservation of mass, momentum, and energy in incompressible flow & flow of a real fluid--including laminar and turbulent flow, dimensional analysis and similitude & the applications to engineering problems.

8. Learning objectives:

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system for hydraulic structures.
2. Develop competence with mass, energy and momentum for determining resultant forces on hydraulic structures.
3. Study of boundary layers and calculation of drag force for practical hydraulic problems.

9. Subject Outcomes:

1. Calculate static and dynamic forces on hydraulic structures.
2. Determine pressure in a closed conduit carrying fluids.
3. Determine unknown factors with the help of dimensional analysis.
4. To calculate the drag forces on a body in a flowing fluid as well as drag forces on a moving body in the fluid with the concept of boundary layer theory.

10. List of Experiments

Sr. No.	**Title**	**CO covered**
1	Conducting experiments to verify Bernoulli's theorem.	1
2	Determination of the Coefficient of discharge of given Venturi-meter.	2
3	Determination of the Coefficient of discharge of given Rectangular notch	2
4	Determination of the Coefficient of discharge of given V- notch.	2
5	Determination of head loss in pipes connected in series.	3
6	To study the performance characteristics of reciprocating pump	3
7	To study the performance characteristics of Centrifugal pump.	1,4
8	Determination of head loss in pipes connected in parallel.	1,4

1. Name of the Department –CIVIL ENGINEERING						
2. Subject Name	**Strength of Materials Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 0**	**Practical =28**			

7. Brief Syllabus

Properties of materials, Stresses and strains, Shear Force, Columns and Struts, Deflection of beams and failures theory and Bending Moment

8. Learning objectives:

1**.** Confidently tackle equilibrium equations, moments and inertia problems.
2. Master calculator/computing basic skills to use to advantage in solving mechanics problems.
3. Gain a firm foundation in Engineering Mechanics for furthering the career in Engineering.

8. Subject Outcomes :

By the end of this course the student will be able to:

1. Identify different materials and their behaviour.
2. Analyse various civil engineering structures under different loading conditions.
3. Apply the principles of structural mechanics in design structural elements.

Sr. No.	**Title**	**CO covered**
1.	Tension test on a mild steel and HYSD bars	1
2	Compression test on Bricks and Concrete cubes	1
3	Experimental determination of elastic constant of steel beams.	1
4	Verification of Maxwell theorem	2
5	Compression and tension test on helical springs	1
6	Torsion test on mild steel and HYSD bars.	2
7	Determination of critical buckling load and deformation of column for different end conditions	3
8	To determine deflection of steel truss	3

1. Name of the Department – Law						
2. Subject Name	**Constitution of India**	**L**	**T**		**P**	
3. Subject Code		2	0		0	
4. Type of Subject (use tick mark)		**MC(√)**	**PE()**		**OE(√)**	
5. Pre-requisite (if any)	NIL	**6. Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials = 00**	**Practical =00**			
7.Unit wise detailed content						
Unit-1	**Number of lectures = 8**	**Introduction and Basic Information about Indian Constitution**				
The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Fundamental Duties and its Scope and significance in Nation building						
Unit – 2	**Number of lectures = 8**	**Union Executive**				
Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.						
Unit – 3	**Number of lectures = 8**	**State Executive**				
State Executives – Governor , Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Article 370.371,371J) for some States						
Unit – 4	**Number of lectures =9**	**Elections, Amendments**				
Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73, 74, 75, 86, and 91, 94, 95,100,101,118 and some important Case Studies. Recent Amendments with explanation. Important Judgements with Explanation and its impact on society (from the list of Supreme Court Judgements).						
8. Brief Description of self-learning / E-learning component The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.						

Sr. No	Specialization	Departmental Elective-I	Departmental Elective-II	Departmental Elective-III	Departmental Elective-IV
1	**Water Resource Engineering**	Ground Water Engineering	Urban water resources management	Hydrology	Water Resources Systems Planning
2	**Geotechnical Engineering**	Engineering Geology	Ground Improvement	Engineering Behavior of Rocks	Environmental Geotechnology
3	**Construction Management**	Civil Engineering Materials	Construction methods and Equipments	Green Building Methodology	Quality & Safety Practices in construction
4	**Geo-Informatics and Remote Sensing**	Surveying Measurements and Adjustments	Principles of Photogrammetric	Remote Sensing and Image Processing	Geodesy and GPS Surveying
5	**Environmental Engineering**	Air Pollution and Control	Water Quality Management	Solid Waste Management	Natural Disaster Mitigation and management

Departmental Electives –I

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Ground Water Engineering**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials =**	**Practical**			

7. Brief Syllabus:

This course covers fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. Introduction and definitions, groundwater storage and supply, Darcy's Law and its limitation, Dupuit approximation, steady and unsteady flows in confined and unconfined aquifers, radial flow towards wells, storage coefficient and safe yield in a water-table aquifer, design of wells, methods of drilling and construction, development of maintenance of wells.

8. Learning objectives:

1. To educate on ground water movement analysis & predictions.
2. To understand the concept to increase ground water potential.
3. To identify the sources of the ground water.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Identify the ground water flow & prediction.
2. Implement the Methods of improving the ground water potential.
3. Manage the ground water sources.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Occurrence and Movement of Groundwater**

Introduction to Hydrologic cycle – Origin and Age of groundwater, classification of groundwater, aquifer - water table - Darcy's Law, Coefficient of Transmissibility and storage - Flow rates and equation.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Well Hydraulics**

Geophysical methods, study of radial flow - well flow, Multiple well system - characteristic well losses, open well, tube well, well depth, well screen - head losses through the screen gravel packing and formation stabilization

Unit – 3	**Number of lectures = 10**	**Title of the unit: Analysis and Evaluation of Pumping Test**

Definition of terms - static water level, pumping level, drawdown – residual, drawdown pumping rate -automatic water level recorder- time drawdown analysis - distance drawdown analysis, Jacob's methods, pumping test methods.

Unit – 4	**Number of lectures = 12**	**Title of the unit:** **Pollution of Groundwater, Groundwater Assessment and Budgeting**

Injection methods-monitoring: - Cement lime, Lime-fly ash and chemical stabilization, Deep mixing techniques.

Hydrological equilibrium - rain gauge network, runoff procedure for conducting infiltration test – artificial recharge, rainwater harvesting – calculation of groundwater storage capacity and groundwater potential.

10. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. Raghunath H.M. (2007), Groundwater, Third Edition, ISBN No. 978-81-224-1904-7, New Age International

Reference books

1. David Keith Todd (2005), Groundwater Hydrology, Third Edition, John Wiley & Sons

2. Abdel-Aziz ismailkashef (2008), Groundwater Engineering, McGraw-Hill International Editions, Newyork

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Ground Water Engineering Laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials =0**	**Practical =0**			

7. Brief Syllabus:

This course covers fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. Introduction and definitions, groundwater storage and supply, Darcy's Law and its limitation, Dupuit approximation, steady and unsteady flows in confined and unconfined aquifers, radial flow towards wells, storage coefficient and safe yield in a water-table aquifer, design of wells, methods of drilling and construction, development of maintenance of wells.

8. Learning objectives:

1. To educate on ground water movement analysis & predictions.
2. To understand the concept to increase ground water potential.
3. To identify the sources of the ground water.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Identify the ground water flow & prediction.
2. Implement the Methods of improving the ground water potential.
3. Manage the ground water sources.

10. Unit wise detailed content

1. Explore the nearby lands for their ground water levels.
2. Study and implement the Darcy law.
3. Explore nearby wells for their types of flow
4. Determine the various types of well losses
5. Analyze and evaluate nearby wells for drawdown and pumping phenomena.
6. Explore the nearby lands for calculation of groundwater storage capacity and groundwater potential.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Engineering Geology**	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core ()	PE-I (✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

Engineering Geology is the application of the geological sciences to Civil Engineering practice for the purpose of recognizing the location, design, construction, operation and maintenance of engineering projects such as Dams, Barrages, Bridges, High rise buildings and other such important projects.

9. Learning objectives:

1-The overall objective of lecture portion of engineering geology is to demonstrate the importance of Geology in making engineering decisions specially site selection of engineering projects.

2. Introduce the fundamentals of engineering properties of earth materials for their use in civil Engineering constructions.

3. Develop quantitative skills and frame work for solving basic engineering geology problems related to geological features and geological hazards and remedial measures thereof.

10. Course Outcomes (COs):

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

1. Characterize and classify various minerals and rocks on the basis of their engineering properties.
2. Identify the exterior and interior structure of various features of rocks
3. Analysis subsurface information and groundwater potential sites through geophysical investigations
4. Understand the recent advancement in the field of geology and Apply geological principles and techniques for mitigation of natural hazards and select sites for dams and tunnels.

11. Unit wise detailed content

Unit-1	**Number of lectures =10**	**Title of the unit: Mineralogy and petrology**

Definition of a crystal and mineral, physical property in mineral identification, rock forming minerals and their identification – quartz and its varieties, feldspar, hornblende, olivine, mica, garnet, kyanite, calcite, talc, bauxite, corundum, gypsum, fluorite, apatite, barite, asbestos, magnetite, hematite.

Formation and classification of rocks – Igneous, Sedimentary and metamorphic rocks, their texture and structures, properties of granite, pegmatite, dolerite, gabbro, charnockite, basalt, sandstone, conglomerate, breccia, limestone, shale, laterite, schist, gneiss, quartzite, marble and slate. Drilling Techniques Engineering Properties of Rocks

Unit - 2	**Number of lectures = 10**	**Title of the unit: Structural Geology**

Geological Map, outcrop, attitude of beds, types and classifications of folds, faults, joints, unconformities.

Unit - 3	Number of lectures = 10	Title of the unit: Weathering and ground water
Rock decay and weathering. Soil origin and formation, classification and its engineering importance, Rock and soil slope stability analysis. Characteristic of ground water, Global distribution of water, Hydro Geological Cycle, Darcy's Law, laboratory permeability tests, Types of aquifers, Water level fluctuations, Surface and subsurface geophysical methods, Groundwater contamination, Artificial recharge of groundwater, Seawater intrusion and harvesting of rainwater.		

Unit - 4	Number of lectures = 12	Title of the unit: **Earthquake and landslide and advanced development in engineering Geology**
Causes and effects of earthquakes and landslides, Remedial measures to prevent damage for engineering structures, Recent development in the field of engineering geology. Challenges and opportunities in the field of engineering geology.		

9. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

12. Books Recommended (3 Text Books + 2-3 Reference Books)

iv) S.K Garg, Physical and Engineering Geology (2012), 7th Edition ISBN No. 81-7409-032-0, Khanna Publications.

v) Reddy, V. Engineering Geology for Civil Engineers; Oxford & IBH, 1997,New Delhi

vi) Todd, D.K. Groundwater Hydrology, John Wiley & Sons, 1980, New York

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

v) N. Chennakesavalu, A Test Book of Engineering Geology, Macmillan Publishers, First Publishers, First Published 1993, Reprint 1997, 1999, 2003, 2004

vi) Guide to Energy Management by B. L. Capehart

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Engineering Geology Laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	PE-I (✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =00		**Tutorials =0**	**Practical =28**			

8. Brief Syllabus

Engineering Geology is the application of the geological sciences to Civil Engineering practice for the purpose of recognizing the location, design, construction, operation and maintenance of engineering projects such as Dams, Barrages, Bridges, High rise buildings and other such important projects.

9. Learning objectives:

1-The overall objective of lecture portion of engineering geology is to demonstrate the importance of Geology in making engineering decisions specially site selection of engineering projects.

2. Introduce the fundamentals of engineering properties of earth materials for their use in civil Engineering constructions.

4. Develop quantitative skills and frame work for solving basic engineering geology problems related to geological features and geological hazards and remedial measures thereof.

10. Course Outcomes (COs):

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

1. Characterize and classify various minerals and rocks on the basis of their engineering properties.
2. Identify the exterior and interior structure of various features of rocks
3. Analysis subsurface information and groundwater potential sites through geophysical investigations
4. Understand the recent advancement in the field of geology and Apply geological principles and techniques for mitigation of natural hazards and select sites for dams and tunnels.

11. Unit wise Detailed Lab content

1- To conduct a study of formation of rock and rock cycle

2- To conduct a microscopic study of identification of Rock

3- Mineral's formation and identification

4- To study the movement procedure of dip and strike formation using clinometer compass

5- Laboratory methods for determination of soil properties

6- Industrial visits to various sites to understand the behaviour of different rocks

7- Characteristics of ground water

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Civil Engineering materials	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		**Core ()**	**PE(✔)**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus: to design a component or a product applying all the relevant standards and with realistic constraints. To use techniques, skills and modern engineering tools necessary for Engineering practice.

8. Learning objectives:

1. To understand the applications and properties of various building materials
2. To know the various types of metals and alloys
3. To understand the potential applications of architectural materials
4. To obtain the knowledge about polymer materials and smart materials
5. To know the various chemical admixtures and special concrete

9. Course Outcomes:

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

1. Compare the properties of most common and advanced building materials
2. Explain the role of metals and alloys in construction industry
3. Identify the required architectural materials for various buildings
4. Explain the role of polymers in construction industry
5. Outline various smart materials suitable for structures

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit:** Building Materials

Cement- types - properties and testing – Aggregate – types - properties and Testing, Reinforcement – Types - Manufacturing Process - Properties – Types of Coatings & Coatings to reinforcement.

Unit - 2	**Number of lectures = 11**	**Title of the unit:** Architectural Materials

Wood and Wood Product – Glass - Floor Finishes – Paints – Tiles - Thermal insulation and acoustic absorption materials - decorative panels and laminates - architectural glass and ceramics - fibrocement.

Unit - 3	**Number of lectures =10**	**Title of the unit:** Polymers and Smart Materials

Neoprene, Bridge pads, thermocol, Smart and Intelligent Materials – Special features –Case studies

showing the applications of smart and Intelligent Materials. Petroleum products, Fibre Reinforced Polymers, Bituminous Materials

Neoprene, Bridge pads, thermocol, Smart and Intelligent Materials – Special features –Case studies showing the applications of smart and Intelligent Materials. Petroleum products, Fibre Reinforced Polymers, Bituminous Materials

Unit - 4	**Number of lectures = 11**	**Title of the unit:** Chemical and Mineral Admixtures

Types and properties of Chemical Admixtures - Water Proofing Compounds– sealants, engineering grouts, various types of finishes & treatments , Fly ash – silica fume – GGBFS - metakaolin - rice husk ash - properties and its application in concrete under special environment.

Self-Compacting Concrete – Lightweight concrete – Self dynamic concrete – Self Healing Concrete

11. Brief Description of self learning / E-learning component

https://swayam.gov.in/course/3697-concretetechnology

12. Books Recommended

1 Kumar Mehta. and Paulo J. M. Monteiro, (2014), Concrete: Microstructure, Properties and Materials, 4th Edition, McGraw-Hill, New Delhi.

REFERENCE BOOKS

1. Shetty. M. S., (2017), Concrete Technology, S. Chand and Company Ltd, New Delhi.

2. George C. Sih, Alberto Carpinteri and Surace, G (Eds.) (2010), Advanced Technology for Design and Fabrication of Composite Materials and Structures: Applications to the Automotive, Marine, Aerospace and Construction Industry, in: Engineering Applications of Fracture Mechanics Series, Springer, Netherlands.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Civil Engineering materials Lab	**L**	**T**		**P**	
3. Course Code		0	0		2	
4. Type of Course		**Core ()**	**PE(✔)**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures =		**Tutorials = 00**	**Practical = 28**			

Brief Syllabus: to design a component or a product applying all the relevant standards and with realistic constraints. to use techniques, skills and modern engineering tools necessary for Engineering practice.

8. Learning objectives:

1. To understand the applications and properties of various building materials
2. To know the various types of metals and alloys
3. To understand the potential applications of architectural materials
4. To obtain the knowledge about polymer materials and smart materials
5. To know the various chemical admixtures and special concrete

9. Course Outcomes:

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

1. Compare the properties of most common and advanced building materials
2. Explain the role of metals and alloys in construction industry
3. Identify the required architectural materials for various buildings
4. Explain the role of polymers in construction industry
5. Outline various smart materials suitable for structures

10. Unit wise detailed content

1. Compressive Strength of Cement Cube (7.07 cm cubes)
2. Determine standard consistency test.
3. Determine Initial and Final setting time of cement
4. Experimental study on strength and durability of special concretes
5. Study on properties of building and composite materials
6. Applications of smart and intelligent materials

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Surveying measurements and adjustments	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		**Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus: To impart skills in survey calculation and adjustment to suit field conditions.

8. Learning objectives:

1 To impart skills in survey calculation and adjustment to suit field conditions.

9. Course Outcomes:

At the end of the course the student will be able to understand

- The concepts of error, error distribution and error adjustment procedures
- The procedure involved in error adjustment using least square adjustment, elementary probability theory and variance covariance propagation

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: MEASUREMENT AND ERROR**

Concepts of measurement and Error – Types of errors – Elementary concepts in probability Reliability of measurement – significant figures.

Unit-2	**Number of lectures = 10**	**Title of the unit: MEASUREMENT AND ERROR**

–Error Propagation- linearization – Multivariate distribution Error ellipse- Weights and cofactors – Non-linear stochastic variables.

Unit - 3	**Number of lectures = 12**	**Title of the unit: GENERAL ADJUSTMENT METHODS**

Introduction – simple adjustment methods – Least squares method – Examples of least squares problems, Level net, triangulation figure adjustment, traverse adjustment.

Unit - 4	**Number of lectures =10**	**Title of the unit: LEAST SQUARES ADJUSTMENT TECHNIQUES**

Techniques of least squares- concept of weight – least squares adjustment of indirect Observations – least squared adjustment of observations only- adjustment of Trisection.

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

http://sgtlms.org

Journal papers; Patents in the respective field.

12. Books Recommended

TEXTBOOKS :

- Mikhail, E.M. and Gracie G., Analysis and adjustment of Survey measurements, Van Nostrand Reinhold, New York, 2005
- Bannister A. and Raymond B., "Surveying", ELBS edition, 2006.
- Bannister A. and Raymond B., "Solving problems in surveying", ELBS edition, 2006.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Surveying measurements and adjustments Lab	**L**	**T**		**P**	
3. Course Code		0	0		2	
4. Type of Course		**Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 00**	**Practical = 28**			
Brief Syllabus: to impart skills in survey calculation and adjustment to suit field conditions						

8. Learning objectives:

1. To impart skills in survey calculation and adjustment to suit field conditions.

9. Course Outcomes:

At the end of the course the student will be able to understand

1. The concepts of error, error distribution and error adjustment procedures
2. The procedure involved in error adjustment using least square adjustment, elementary probability theory and variance covariance propagation

10. Unit wise detailed content

1. Concepts of measurement and Error
2. Significant figures
3. Study of Multivariate distribution Error ellipse
4. Study of simple adjustment methods
5. Study of triangulation figure adjustment
6. Study of adjustment of Trisection

1. Name of the Department: Civil Engineering						
2. Course Name	Air Pollution and Control	**L**	**T**		**P**	
3. Course Code		3	0		4	
4. Type of Course (use tick mark)		**Core (✔)**	**PE ()**		**OE ()**	
5. Pre-requisite (if any)	Basics of Environment Quality Measures	**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

8. Brief Syllabus

This will enhance the learner basics about Air Pollution, its prevention methods, the techniques employed to reduce or eliminate the emission into the atmosphere of substances that can harm the environment or human health. These include adverse effects on human health, property, and atmospheric visibility.

9. Learning objectives:

The course is intended

1. To understand the basics of Air Pollution.
2. To enhance learner skills for control and remedial measures against Air Pollution.
3. To teach measures and technologies required to prevent air pollution.

10. Course Outcomes (COs):

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

1. Identify the type the source of pollutant.
2. Monitor the Air pollution and analyse the samples.
3. Control air pollution using different ECS.
4. To apply methods to control Air Pollution
5. To disseminate knowledge in society to prevent Air Pollution.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Air Pollution & its Classification**

Definition of Air Pollution, Causes, Air Quality Monitoring Methods, Classification of Air Pollutants.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Effects & Prevention of Air pollution**

Effects of Air pollution on human, plant and animal. Preventive measures against Air Pollution. Air Pollution Hazardous level causing -Factors and control measures.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Air Pollution Monitoring & Emission Control Systems**

Collection of Gaseous Air Pollutants, Collection of Particulate Pollutants, Measurement of SO_2, NO_x, CO. Basics of Ozone and its applications.

Air pollution control technologies for particulates and gaseous contaminants. Introduction to Gravity settlers, Electrostatic precipitators, Bag Filters, Scrubbers and Cyclone Control Systems.

Unit - 4	Number of lectures = 10	Title of the unit: Meteorology & Dispersion of pollutants
Introduction to Wind Circulation phenomenon, Lapse Rate, Stability Conditions, Maximum Mixing Depths, Plume Rise & dispersion. Exposure to applications based on current industrial trends.		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i) M. N. Rao& H V N Rao (2000), Air pollution, Tata McGraw Hill Publishing Ltd

ii) 'Fundamentals of Air Pollution' authored by Daniel Vallero, 4th Edition, Elsevier's Science & Technology, 2008 (ISBN: 978-0-12-373615-4).

iii) 'Air Pollution Control Technology Handbook' authored by Karl B. Schnelle, Jr. and Charles A. Brown, CRC Press, 2002 (ISBN 0-8493-9588-7).

iv) 'Air Pollution Control Engineering' Edited by Lawrence K. Wang, Norman C. Pereira and Yung Tse Hung, Humana Press Inc, 2004 (ISBN: 1-58829-161-8).

v) 'Advanced Air and Noise Pollution Control' Edited by Lawrence K. Wang, Norman C. Pereira and Yung-Tse Hung, Humana Press Inc, 2005 (ISBN: 1-58829-359-9).

1. Name of the Department: Civil Engineering						
2. Course Name	Air Pollution & Control Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE ()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward Air Pollution & its Control Measures. In addition to that, this course will inculcate the understanding about parameters involved in the determination of air quality.

8. Learning objectives:

1. Understand the monitoring processes of air variables.
2. To gain insight into basic concept of various atmospheric phenomenon
3. Understand the parameter involved in determination of air quality.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of variables of air quality.
2. Apply the understanding of analytical techniques toward parameters that control the air quality.

8. Unit wise detailed content

1. To monitor the respirable particulate matter.
2. To monitor the gases and particulates in ambient air
3. To monitor the indoor air quality.
4. To measure the meteorological parameters.
5. To assess the bioaerosol.
6. To assess control measures against air pollution.
7. Elaborate different types of air pollutants.
8. Determine the air quality in a region.
9. Estimation ways of Air Quality Parameters
10. Measurement of CO level.

Departmental Elective –II

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Urban Water Resources Management**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 33		**Tutorials =00**	**Practical = 00**			

7. Brief Syllabus

Student will study the ways in which water availability and use are matched, and seek to develop alternative land use and water allocation policies, including legal and institutional arrangements from the local watershed to the basin scale and beyond.

8. Learning objectives:

1. To introduce the concepts of urbanization and its impact on the natural water cycle
2. The student is exposed to the use the urban storm water models for better storm water management.
3. Students also exposed for the preparation of urban storm water master plan and different types of operation and maintenance.

9. Subject Outcomes:

At the completion of the course the student should be able to

1. Apply appropriate management techniques for planning, operating and maintaining the different components of urban and drainage system.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Urban Hydrologic Cycle**

Water in the urban eco-system – Urban Water Resources – Major problems – Urban hydrological cycle – Storm water management objectives and limitations – Storm water policies – Feasibility consideration

Unit - 2	**Number of lectures = 10**	**Title of the unit: Urban Water Resources Management Models**

Types of models – Physically based – conceptual or unit hydrograph based – Urban surface runoff models – Management models for flow rate and volume control rate – Quality models.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Urban Storm Water Management & Master Plans**

Storm water management practices (Structural and Non-structural Management measures) – Detention and retention concepts – Modelling concept – Types of storage – Magnitude of storage – Hydraulic analysis and design guidelines – Flow and storage capacity of urban components – Temple tanks.

Planning and organizational aspects – Inter dependency of planning and implementation of goals and measures – Socio – economic financial aspects – Potential costs and benefit measures – Measures of urban drainage and flood control benefits – Effective urban water user organizations.

Unit – 4	**Number of lectures = 12**	**Title of the unit: Operation And Maintenance**

General approaches to operations and maintenance – Complexity of operations and need for diagnostic analysis – Operation and maintenance in urban water system – Maintenance Management System – Inventories and conditions assessment – Social awareness and involvement.

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. Geiger, W.F., Marsalek, F., and Zuidena, F.C., (Ed), manual on drainage in urbanized areas – Vol.1 and Vol.II, UNESCO.

Reference Books

1.Neil S. Grigg., Urban Water Infrastructure Planning, Management and Operations, John Wiley and Sons
2. Hengeveld, H. and C. De Voch.t (Ed)., Role of Water in Urban Ecology
3. Martin, P. Wanelista and Yousef, A. Yousef., Storm Water Management, John Wiley and son

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Urban Water Resources Management Laboratory**	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials =0**	**Practical =28**			

7. Brief Syllabus:

Student will study the ways in which water availability and use are matched, and seek to develop alternative land use and water allocation policies, including legal and institutional arrangements from the local watershed to the basin scale and beyond.

8. Learning objectives:

1. To introduce the concepts of urbanization and its impact on the natural water cycle
2. The student is exposed to the use the urban storm water models for better storm water management.
3. Students also exposed for the preparation of urban storm water master plan and different types of operation and maintenance.

9. Subject Outcomes:

At the completion of the course the student should be able to

1. Apply appropriate management techniques for planning, operating and maintaining the different components of urban and drainage system.

10. Unit wise detailed content

1. To determine mean rainfall of an area by isohyetal method.
2. The determine mannings rogosity coefficient.
3. To determine the velocity of a running of a stream in a canal by current meter and Calculate the approximate discharge of the canal.
4. To design a regime channel by Lacey's theory for a given .pattern of crops and area to be Irrigated.
5. To determine the yield of an open well by recuperation test.
6. To determine the yield of an open well by constant level pumping test.
7. To visit a Multipurpose River valley, project and to prepare a report of the solid project.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Ground Improvement**	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core ()	PE-(✔)		OE()	
5. Pre-requisite (if any)	Soil mechanics	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

This course covers the improvement of ground by adopting mechanical modification, hydraulic modification, chemical modification and reinforcement techniques.

9. Learning objectives:

To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.

• To bring out concepts of reinforced earth.

• Applications of geotextiles in various civil engineering projects.

10. Course Outcomes (COs):

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

1-Understanding the engineering behaviour of various natural and man-made soil deposits and Identify the problems associated with the existing ground condition.

2-Competence in understanding the Seepage and drainage and dewatering

3-Ability to analyze a field challenge and to recognize physical and chemical modification of soil

4-Expousure to recent ground improvement techniques through various case studies

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Introduction: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques – suitability and feasibility. Weak deposits of India.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Drainage and dewatering**

Methods of dewatering – open sumps and ditches, Well-point system, Electro-osmosis, Vacuum dewatering wells; pre-loading with sand drains - strip drains, Design of vertical drains.

Unit - 3	**Number of lectures = 10**	**Title of the unit:** Physical and chemical modification:

Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting –

materials and methods.

Unit - 4	Number of lectures = 12	Title of the unit: Reinforced Earth Technology ,Recent development in ground improvement

Concept of soil reinforcement, Reinforcing materials, Backfill criteria, Design of reinforcement for internal stability, Applications of Reinforced earth structures. Ground Anchors and Soil Nailing: Types of ground anchors and their suitability, Uplift capacity of anchors; Soil nailing and Applications.

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i)Koerner R.M., "Construction and Geotechnical Methods in Foundation Engineering", McGraw-Hill, 1994.

ii) Purushothama Raj, P "Ground Improvement Techniques" Laxmi Publications (P) Limited, 2006.

iii) Moseley M.P., Ground Improvement Blockie Academic and Professional, Chapman and Hall, Glassgow, 1993.

iv) Jewell, R.A., "Soil Reinforcement with Geotextiles", CIRIA special publication, London, 1996

v) Manfred R. Haussmann - Engineering principles of ground modification – Pearson Education Inc. New Delhi, 2008.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Ground Improvement Techniques Laboratory**	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	PE-VII(✔)		OE()	
5. Pre-requisite (if any)	Soil mechanics	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =00		**Tutorials =0**	**Practical =28**			

8. Brief Syllabus

This course covers the improvement of ground by adopting mechanical modification, hydraulic modification, chemical modification and reinforcement techniques.

9. Learning objectives:

To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.

• To bring out concepts of reinforced earth.

• Applications of geotextiles in various civil engineering projects.

10. Course Outcomes (COs):

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

1-Understanding the engineering behaviour of various natural and man-made soil deposits and Identify the problems associated with the existing ground condition.

2-Competence in understanding the Seepage and drainage and dewatering

3-Ability to analyse a field challenge and to recognize physical and chemical modification of soil

4-Expousure to recent ground improvement techniques through various case studies

11. Unit wise detailed lab content

1- Study about ground modification techniques

2- Characterization of methods as per soil properties

3- Understanding the various laboratory methods for shallow compaction

4- To study about Dynamic compaction test

5- Drainage and dewatering methods

6- Field visit to understand the grouting techniques

7- Soil reinforcement methods and selection criteria of reinforcement

1. Name of the Department: Civil Engineering Department						
2. Course Name	Construction Methods and Equipment	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core ()	PE-(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

Construction Methods and Equipment course includes the study of modern construction material, Modern construction methods and equipment's and advanced study of polymers in the field of civil engineering.

9. Learning objectives:

1. To create an awareness in Engineers about construction methods and equipment's.
2. To understand the modern materials used in modern construction.

10. Course Outcomes (COs):

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

1. Students understand the technology of uses of modern material and equipment.
2. Understand the significance of construction methods involve in modern construction techniques
3. Use of different construction equipment's and their capabilities.
4. Identify the properties of advanced polymers

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Modern Construction Materials**

Study of Advance Building Materials like, Aluminium, Glass, fabric, various types of finishes & treatments, Construction chemicals – sealants, engineering grouts, mortars , admixtures and adhesives, Plastic, FRP.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Construction Methods**

Precast Flat Panel System, 3d Volumetric Construction, Tunnel Boring Methods, Precast Foundations. Fabrication of Pre-Cast and Pre-Stressed Components, Reinforcing Steel: Types, Bending, Placing, Splicing and Spacing, Tendons- Soil Improvement - Mechanical, Thermal.

Unit – 3	**Number of**	**Title of the unit: Construction Equipment**

	lectures = 10	
Equipment for Excavating, Dredging, Trenching, Tunneling, Drilling, Blasting-Equipment for compaction-Erection Equipment- Types of pumps used in construction-Equipment for Dewatering and Grouting-Foundation and Pile Driving Equipment		
Unit – 4	**Number of lectures = 12**	**Title of the unit: Study of advanced Polymers in Civil Engineering**
Polymers in Civil Engineering-Structural Plastics and Composites- Polymer Membranes Coatings-Adhesives, Non - Weathering Materials-Flooring and Facade Materials- Glazed Brick, Photo Catalytic Cement, Acid Etched Copper and Composite Fiber Metals-Metals and Special Alloys Of Steel.		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i) Shan Somayaji, “Civil Engineering Materials ", 2nd Edititon , Prentice Hall Inc., 2001.

ii) Mamlouk, M.S. and Zaniewski, J.P., " Materials for Civil and Construction Engineers ", Prentice Hall Inc., 1999.

iii) Derucher, K.Korfiatis. G. and Ezeldin, S., " Materials for Civil and Highway Engineers ", Prentice Hall Inc., 1999. 4th Edition

iv) Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., “Construction Planning, Equipment and Methods ", 5th Edition, McGraw Hill, Singapore, 1995. 5. Sharma S.C. “Construction Equipment and Management ", Khanna Publishers New Delhi, 1988.

v) Dr. Mahesh Varma, “Construction Equipment and its Planning and Application ", Metro-politan Book Company, New Delhi-, 1983.

vi) Deodhar, S.V. “Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 1988.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Construction methods and Equipments Laboratory**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-(✔)		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()

6. Total Number of Lectures, Tutorials, Practical		
Lectures = 00	**Tutorials = 00**	**Practical = 28**

7. Learning objectives:

1. To create an awareness in Engineers about construction methods and equipment's
2. To understand the modern materials used in modern construction

8. Course Outcomes (COs):

At the end of the lab course student able to

1-Students understand the technology of uses of modern material and equipment.

2-Understand the significance of construction methods involve in modern construction techniques

3-Use of different construction equipment's and their capabilities.

4-Identify the properties of advanced polymers

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Identification and determination of properties of modern building materials
2	Tunnel Boring Methods
3	Study about precast and cast in-Situ construction methods of foundation
4	Understanding the pre-tensioning and post tensioning methods
5	Field Grout methods and its effect
6	Drilling methods
7	Understanding of different types of polymers used in construction
8	Freezing and thawing test for materials

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Principles of Photogrammetric	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		**Core ()**	**PE(✔)**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus: The fundamental principle used by **Photogrammetry is triangulation. By** taking photographs from at least two different locations, so-called "lines of sight" can be developed from each camera to points on the object.

8. Learning objectives:

The major objective of Photogrammetry is to relate the pixel coordinates measured by the sensor as exactly as possible to the geographic coordinates (longitude, latitude, height) of terrain points.

9. Course Outcomes:

At the end of the course the student will be able to understand

- Will learn about the Photogrammetry and its types.
- Will learn about the stereoscopy.
- Will able to learn about the analytical Photogrammetry.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Definition and terms, history of Photogrammetry, concepts, principles and types of Photogrammetry, types of aerial photographs vertical photographs, tilted photographs, ortho photographs, aerial cameras, geometry and scale orientation and measurements, distortions, displacements and their corrections, rectification and ortho photographs, digital imaging devices and their characteristics and advantages over other analogue cameras, satellite stereo images.

Unit-2	**Number of lectures = 10**	**Title of the unit: Stereoscopy**

Principles of stereoscopic vision, types of stereoscopes, stereoscopic viewing, stereoscopic parallax

Unit - 3	**Number of lectures = 12**	**Title of the unit: Analytical Photogrammetry**

image measurements, control points, collinearity equations, coplanarity equations, Epipolar geometry analytical interior orientation, analytical relative orientation, analytical absolute orientation

Unit - 4	**Number of lectures =10**	**Title of the unit: Project Planning**

flight planning, pre-pointing and post pointing, photographic end lap and side lap, purpose of photography, photo scale, flying height, ground coverage, weather conditions, season of the year, flight map, specifications, cost estimation and scheduling, use of Drone/Unmanned Aerial Vehicles (UAV) system in data capturing.

11. Brief Description of self learning / E-learning component

1. https://swayam.gov.in/course/3697-concretetechnology

12. Books Recommended

TEXTBOOKS :

- Wolf, P.R. Elements of Photogrammetry, McGraw Hill, New York, 1974
- Moffitt, F.H. and Mikhail, E.M. Photogrammetry, Harper and Row, New York, 1980
- Rampal, K.K. Textbook of Photogrammetry, Oxford and IBH Publication, New Delhi, 1982
- Slama, C.C. (Ed.) Manual of Photogrammetry, American Society of Photogrammetry, Fall Church, Virginia, 1980

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Principles of Photogrammetric Lab	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		**Core ()**	**PE(✔)**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 00**	**Practical = 28**			

Brief Syllabus: The fundamental principle used by Photogrammetry is **triangulation**. By taking photographs from at least two different locations, so-called "lines of sight" can be developed from each camera to points on the object.

8. Learning objectives:

The fundamental principle used by Photogrammetry is triangulation. By taking photographs from at least two different locations, so-called "lines of sight" can be developed from each camera to points on the object.

9. Course Outcomes:

At the end of the course the student will be able to understand

- Will learn about the Photogrammetry and its types.
- Will learn about the stereoscopy.
- Will able to learn about the analytical Photogrammetry.

10. Unit wise detailed content

1. Study of Principles and types of Photogrammetry
2. Study of displacements and their corrections
3. Study of Principles of stereoscopic vision
4. Study of Epipolar geometry analytical interior orientation, analytical relative orientation
5. Study of analytical absolute orientation
6. Study of use of Drone/Unmanned Aerial Vehicles (UAV) system in data capturing.

1. Name of the Department: Civil Engineering						
2. Course Name	Water Quality Management	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		**Core ()**	**PE (✔)**		**OE ()**	
5. Pre-requisite (if any)	Environmental Chemistry and Microbiology	**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 00**			

8. Brief Syllabus

The purpose of the course is to develop understanding of water quality criteria, standards, impacts of water pollutants and treatment methods. It focuses on cause and effects of water pollution and water quality degradation from range of sources. Further, it illustrates each unit processes, functions of the processes in water or wastewater treatment and basic equipment that each process uses.

9. Learning objectives:

1. To understand water quality criteria, and standards.
2. To comprehend knowledge about sources, cause and impacts of water pollutants.
3. To be abreast with physical, chemical and biological methods water treatment.

10. Course Outcomes (COs):

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

1. Gain insight into key concepts of water quality, water quality and health, impairment of natural water bodies.
2. Comprehend components of water treatment and schemes based on source of water, select suitable unit process and unit operation at conceptual, theoretical, methodical level.
3. Comprehend components of wastewater treatment and schemes based on input water quality and desired water quality.
4. Develop an integrated perspective on water resource and water quality management.
5. Able to acclimatize in various treatment plants at municipal level.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Basics of water pollutants, impacts, quality criteria and standards**

Introduction to water quality and health linkage; impurities (pollutants and contaminants) in water, significance; water borne diseases; standards of potable water. Impact of water pollutants on environment; self-purification of waste in streams; zones of purification; eutrophication; disposal standards and philosophy of MINAS. Lake systems: thermal stratification, dissolved oxygen.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Water treatment for public water supply**

Aeration and types of aerators; purpose and mechanism of flocculation; coagulants used in waste treatment, factors influencing coagulation, types of flash mixers and flocculators, sedimentation tanks, Filtration: types, factors effecting efficiency of filtration.

Disinfection: chemical and non-chemical methods; chick's law; Tertiary treatment methods for removal

of colour, salinity, hardness, ions, Treatment process including: Adsorption, Reverse Osmosis; Electro-dialysis; Ion-exchange, and Distillation techniques.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Wastewater treatment for municipal sewage**

Physical treatment methods-screen chamber; grit separators; primary and secondary settling tanks. Biological treatment: Biology of sewage treatment; BOD growth curve, types of biological treatment processes, removal of nitrogen and phosphorus, Sludge stabilization and dewatering systems, low cost sewage treatment technologies-septic tanks; reed bed, oxidation, ponds and lagoons.

Unit - 4	**Number of lectures = 10**	**Title of the unit: Contemporary issues in water resource management and pollution control strategies**

Water stress index; status and trend of surface and groundwater; issues and policy interventions; pollution of rivers, lakes and ground water; GAP and National River Action Programme; role of national and international agencies in water health and sanitation. Exposure to applications based on current industrial trends.

12. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Gilbert M. Masters and Wendell P. Ela (2017) Introduction to Environment Engineering and Science. 3rd ed. Pearson,
2. Garg S.K. (2007) Sewage Disposal and Air Pollution Engineering, 20th ed, Vol. II, New Delhi, Khanna Publisher.
3. Garg S.K. (2007) Water Supply Engineering, 18th ed, Vol.I, New Delhi, Khanna Publisher.
4. Birde G.S. and Birde J.S. (2004) Water Supply and Sanitary Engineering, 7th ed., New Delhi, Dhanpat Rai Publishing.
5. Chatterjee A.K. (2010) Water Supply, Waste Disposal and Environmental Engineering, 8th ed., New Delhi, Khanna Publisher.

1. Name of the Department: Civil Engineering						
2. Course Name	Water Quality Management Lab	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Even (√)	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward water system. In addition to that, this course will inculcate the understanding about parameters involved in the water quality management.

8. Learning objectives:

1. Understand the processes for water quality management.
2. To gain insight into basic concept of water quality management.
3. Understand the parameter involved in determination of water quality management variables.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of water quality management.

2. Apply the understanding of analytical techniques toward parameters that influences water quality management.

8. Unit wise detailed content

1. Determination Dissolved Oxygen and BOD for the given sample
2. Determination of COD for given sample
3. Determination of pH, Turbidity and conductivity
4. Determination of Alkalinity and Acidity
5. Determination of suspended, settleable, volatile and fixed solids.
6. Determination of Chlorides
7. Determination of Phosphates and Sulphates
8. Determination of Iron and Fluoride
9. Determination of Optimum Coagulant dosage
10. Determination of residual chlorine and available chlorine in bleaching powder.

4th Semester

1. Name of the Department: Civil Engineering Department						
2. Course Name	Soil Mechanics	L	T		P	
3. Course Code	Nil	3	0		0	
4. Type of Course (use tick mark)		Core (✔)	PE()		OE()	
5. Pre-requisite (if any)		**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

Syllabus of soil mechanics including the soil formation process, engineering properties of soil, weigth - volume relationships, soil-water interaction mechanism and consolidation and strength properties of soil mass.

9. Learning objectives:

1. To impart the fundamental concepts of soil mechanics and study of various classification of soil.
2. To know the importance of index properties like grain size, consistency limits, soil classification.
3. To understand the concept of compaction and consolidation of soil.

10. Course Outcomes (COs):

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

1. Understand the origin of the soil and geological cycle and Apply principles of phase diagram for soil properties and perform basic weight-volume calculations
2. Understand basics principles of flow and soil permeability through porous media including different methods , Darcy's Law, and Hydraulic conductivity
3. Understand how stresses are transferred through soils and be able to compute both geostatic and induced stresses due to point, line, and area loads.
4. Estimate the coefficient of consolidation required for settlement under a given load.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Soil Formation, Weight- Volume relations and Index properties**

Importance of soil engineering- Major soil deposits of India. Distribution of soil in India, Soil - Types, 3-phase diagram, Weight-volume relations, Classification, Index properties (Atterberg's limits), Theory of compaction, Importance of geotechnical engineering.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Soil water**

Types of soil water, Capillarity in soils, Permeability of soils, Darcy's law, Determination of permeability of soils, Permeability of stratified soils, Seepage velocity, Absolute coefficient of permeability, Factors affecting permeability- Effective stress principle, Seepage pressure-Quick sand condition

Unit – 3	**Number of lectures = 10**	**Title of the unit: Stress distribution in soils and Compaction**

Stress distribution in Soils: Importance of estimation of stresses in soils – Boussinesq's and Westergaard theories for point loads, Newmark's influence chart, Contact pressure distribution in sands and clays

Compaction of Soils: Definition and importance of compaction – Standard Proctor compaction test, Modified compaction test- Factors affecting compaction- Influence of compaction on soil properties – Field compaction and its control, Relative compaction.

Unit – 4	**Number of lectures = 12**	**Title of the unit: Consolidation, Strength and recent development in soil mechanics**

Types of compressibility – Immediate settlement – Primary consolidation and secondary consolidation, Normally consolidated soil, Over consolidated soil and under consolidated soil- pre consolidation pressure and its determination- Consolidation test, Estimation of settlements -Terzaghi 1-D consolidation theory – Coefficient of consolidation and its determination - Spring analogy. Shear strength introduction and tests, Recent development in soil mechanics. Case studies in recent development in soil mechanics.

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i) Dr. K.R. Arora, Soil Mechanics and Foundation Engineering(2011), ISBN No. 81-8014-112-8, Seventh Edition, Standard Publishers Distributors, Delhi.

ii) Soil Mechanics and Foundation Engineering by Dr. P.N. Modi , (ISBN-13: 9788189401306)

iii) Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, Wiley Eastern Ltd., New Delhi, 2016

iv) William Powrie, Soil Mechanics: Concepts and Applications, Spon Press.

v) Soil Mechanics and Foundation Engineering by B.N.D. Narsinga Rao, 2015, Wiley India Pvt. Ltd. New Delhi.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Structural Analysis**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Strength of Materials, Engg. Mechanics	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

9. Brief Syllabus: Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures

8. Learning objectives:

1. To understand the methods of analysis.
2. To know the different techniques available for the analysis of structures.
3. To identify the best suitable method of analysis.

9. Subject Outcomes: On completion of this course, the students will be able to

1. Identify the method of analysis for determinate structures
2. Understand the importance of various methods of slope and deflections for determinate structures.
3. Use the influence line diagram.
4. Understand the methods of analysis for indeterminate structures.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Analysis of Indeterminate Structures**

Static determinacy and indeterminacy, Theorem of three moments, analysis of beams and Frames & draw bending moment and shear force diagram using slope deflection method, moment distribution method.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Analysis of Arches**

Two hinged and three hinged parabolic arches, circular arches, cables, influence line for horizontal thrust and bending moment in arches

Stain Energy - Castigliano's theorem - calculation of deflection in statically determinate beams and trusses - Unit load methods.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Strain Energy Method**

Strain energy method for analysis of indeterminate structures, beams, pin jointed and rigid jointed structures, temperature effect, and bending moment and shear force diagram.		
Unit - 4	**Number of lectures = 12**	**Title of the unit: Influence Line**
Influence line- influence lines for bending moment and shear force for beams, Muller Breslau's principle, Maxwell's reciprocal theorem, Maxwell Betti's theorem		

11. Books Recommended

Text Books

1. R.C. Hibbler , Structural Analysis (2011) , Pearson Education

Reference Books

1. Jain, O.P. and Jain, B.K., "Theory & Analysis of Structures". Vol.I & II Nem Chand brothers.
2. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill
3. Chukia Wang
4.Coates,R.C.,Coutie,M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Soil Mechanics Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		Core ()	PE()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Learning objectives:

1. To impart the fundamental concepts of soil mechanics and study of various classification of soil.
2. To understand and calculate the bearing capacity of substrata for the foundation of various Civil Projects.
3. To know the importance of index properties like grain size, consistency limits, soil classification.
4. To understand the concept of compaction and strength behaviour of soil

8. Course Outcomes (COs):
At the end of the lab course student able to
1-Understand the importance of water content test in the field of foundation design in soil
2-Analyse how porous the soil is or how many voids it contains
3-Classify fine grained soil and calculate activity of clays and toughness index of soil.
4-Determine the percentage of different grain sizes contained within a soil
5-Understand the soil bearing capacity, stability, and to determine the degree **of** compaction **of** the fills.
6-Determine maximum dry density and optimum moisture content of soil and analyse the denseness of soil
7-Solve the issues related to the: Yield of water bearing strata
8-Analyze the stability and strength of different types of soil
9. Unit wise detailed lab content
1- Laboratory Test for determination of Water content by Oven drying method
2- Laboratory Test for determination of specific gravity by pycnometer method
3- Laboratory test for determination of Liquid & Plastic Limit of soil.
4- Laboratory tests for Grain size analysis of soil sample
5- Laboratory test for determination of In Situ Density – Core cutter & Sand Replacement
6- Laboratory Standard Proctor Compaction Test and Modified Proctor Compaction Test.
7- Laboratory Permeability Test
8- Shear strength measurement methods

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Structural Analysis Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Strength of Materials, Engg. Mechanics	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 00		**Tutorials = 00**	**Practical =28**			

10. Brief Syllabus: Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures.

8. Learning objectives:

1. To understand the methods of analysis.
2. To know the different techniques available for the analysis of structures.
3. To identify the best suitable method of analysis.

9. Subject Outcomes: On completion of this course, the students will be able to

1. Identify the method of analysis for determinate structures
2. Understand the importance of various methods of slop and deflections for determinate structures.
3. Use the influence line diagram.
4. Understand the methods of analysis for multi-storeyed frames

10. Unit wise detailed content

List of Experiments

Sr. No.	**Title**	**CO covered**
1	Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.	1,2
2	To determine the Flexural Rigidity of a given beam.	1
3	To verify the Moment- area theorem for slope and deflection of a given beam.	2
4	Deflection of a fixed beam and influence line for reactions.	3
5	Deflection studies for a continuous beam and influence line for reactions.	3
6	Study of behavior of columns and struts with different end conditions.	1
7	Experiment on three hinged arch.	1
8	Experiment on two hinged arch.	1
9	Deflection of a statically determinate pin jointed truss	2

1. Name of the Department	CIVIL ENGINEERING					
2. Course Name	Research Methodology	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core (√)	PE-()		OE()	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		Tutorials = 00	Practical = 0			

8.Brief Syllabus:

The aim of the course is to make students understand the importance of Research Paper Writing. Also, it covers all the concepts which involved in writing the Research Paper.

9Learning objectives:

The objectives of the course are:

1. The students are able to recognize the steps involved in doing research work.
2. The students will be able to collect data using various media and using the best possible sample available.
3. The students would learn to propose their Hypothesis and build models for the problem.
4. The students would be able to correctly document their findings in the form of a report.

10.Course Outcomes:

After completion of this course, the student will be able to:

1. Recognize the various steps involved in research.
2. Collect data from samples, Examine and analyze the data.
3. Develop models for problems.
4. Explain the entire process in the form of a report.

11.Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Research - Types, Research process and steps, Hypothesis, Research Proposal and aspects. Research Design- Need, Problem Definition, Variables, Research Design concepts, Literature survey and review, Research design process, Errors in research. Research Modeling- Types of models, model building and stages, Data consideration.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Sampling**

Sampling and data collection- Techniques of sampling, Random, Stratified, Systematic, Multistage-sampling, Primary and secondary sources of data. Design of questionnaire.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Data Collection and Experiments**

Design of Experiments- Objectives, strategies, Factorial experimental design, designing engineering experiments, basic principles-replication, randomization, blocking, guidelines for design of experiments.

Unit - 4	Number of lectures = 10	Title of the unit: Models and Hypothesis & Report writing

Single factor experiment- Hypothesis testing, analysis of Variance component (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effect model, estimation of variance components, Model adequacy checking.
Structure and components of Scientific Reports, Types of Report, Technical Reports and Thesis; Different steps in the preparation – Layout, structure and Language of typical reports; Illustrations and tables, Bibliography, Referencing and foot notes.

12.Brief Description of self learning / E-learning component

https://research-methodology.net/research-methodology/
https://gradcoach.com/what-is-research-methodology/

13.Books Recommended

Text Book:

1. Research Methodology – Methods and Techniques – C.R. Kothari, New Age International, New Delhi, 2004.

Reference Book:

1. Design and Analysis of Experiments – Douglas C. Montgomery, Wiley India, 8th Edition, 2012.
2. Practical Research: Planning Design – Paul D. Leddy, London, 1980.

Departmental Elective – III

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Hydrology**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures =42		**Tutorials = 00**	**Practical = 00**			

7. Learning objectives:

1. To provide knowledge to students regarding occurrence of rainfall, storage of water, estimation of Flood.
2. The students shall learn about ground water permeability and transmissibility and yield of water From well.

8. Subject Outcomes: On completion of this course, the students will be able to

1. The students shall learn to estimate rainfall and perform hydrograph analysis.
2. Extract maximum amount of water from around aquifers after locating them.
3. Perform calculation for flood routing for various irrigation projects.

9. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction and Runoff**

Hydrologic cycle, scope and application of hydrology to engineering problems, drainage basins and its characteristics, stream geometry, hypsometric curves.

Types & forms of precipitation, rainfall measurements, interpretation of rainfall data. Missing rain fall data, Runoff, runoff cycle, infiltration indices, Hydrograph analysis, Module hydrograph, applications. Time Series Analysis

Unit – 2	**Number of lectures = 10**	**Title of the unit: Evaporation, Transpiration and Infiltration**

Evaporation Process: Process, evaporimeters and empirical relationships, analytical method, reservoir evaporation and methods of its control.

Transpiration Process: Evapo-transpiration and its measurement, Penman`s equation and potential evapo-transpiration.

Infiltration Process: Infiltration process, initial loss, infiltration capacity and measurement of infiltration, infiltration indices.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Ground Water Hydrology**

Ground water-Aquifers, Permeability & transmissibility- steady flow towards a well in confined & water table aquifer-Dupits & Theims equation - measurement of yield of an open well - Tube well & infiltration galleries. Interference among wells-well losses, comparison of well and flow irrigation.

Unit – 4	**Number of**	**Title of the unit:**

	lectures = 12	**Flood Routing**
Introduction to flood routing and its importance for the construction of hydraulic reservoirs. Hydrologic routing and hydraulic routing. Methods of flood routing- Step by step method, trial and error method.		

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Engineering Hydrology**,** K Subramanian (2014), 4th Edition, ISBN No. 978-1-25902997-4, Tata McGraw Hill.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Hydrology lab**	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials =0**	**Practical =28**			

7. Learning objectives:

1. To provide knowledge to students regarding occurrence of rainfall, storage of water, estimation of Flood.
2. The students shall learn about ground water permeability and transmissibility and yield of water From well.

8. Subject Outcomes: On completion of this course, the students will be able to

1. The students shall learn to estimate rainfall and perform hydrograph analysis.
2. Extract maximum amount of water from around aquifers after locating them.
3. Perform calculation for flood routing for various irrigation projects.

9. Unit wise detailed content

1. Examine the local Runoff values and calculate nearby stream, canal discharge.
2. Study the last 5 year rainfall data for preparing hydrograph of local area.
3. Study the factors affecting local infiltration rate.
4. Calculate the infiltration capacity of nearly places.
5. Calculate the evaporation rate of local places
6. Study the factors affecting evapotranspiration
7. Calculate nearby area losses in runoff.

1. Name of the Department: Civil Engineering Department						
2. Course Name	Engineering Behavior of Rocks	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core ()	PE(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =32		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

Syllabus of engineering behavior of rocks including brief study of rocks,minerals,identifaction procedures for rocks and minerals, representation of geological data, testing and identification of rocks, rocks failure theories and rock stability methods.

9. Learning objectives:

This subject is taught to impart knowledge the mechanical behaviour of rocks, based firmly upon experimental data, which can be used to explain how rocks deform, fracture and yield, and to show how this knowledge can be used in design.

10. Course Outcomes (COs):

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

1- Identify and analysis the properties of minerals and rocks

2- Understand the representation of geological and geographic data

3- Determine the engineering properties of rocks

4-Understand and analysis the difficulties comes in engineering projects when founded on deep rock strata and recent techniques to improve the stability of different types of rocks.

11. Unit wise detailed content

Unit-1	**Number of lectures =08**	**Title of the unit: Introduction**

Minerals and Rock classes, mineral identification procedure, rock identification procedure, geological structures and discontinuities.

Unit - 2	**Number of lectures = 08**	**Title of the unit: Representation of geological data**

Spherical Representation of geological data, Application of Graphical representation of geological data, rock sampling techniques.

Unit - 3	**Number of lectures = 09**	**Title of the unit: Testing and identification of rocks**

Laboratory testing of Rocks- Preparations & UCS, Factors Influencing UCS & Modes of Failure in Compression, Failure Mechanism and Post-Failure Behavior in Compression, Indirect Method for UCS, Indirect Method for UCS, Brazilian Test, Rebound Hardness Test, Sound Velocity Test, Slake Durability Test, Swelling Pressure and Free Swell Test & Void Index Test

Unit - 4	**Number of lectures = 07**	**Title of the unit: Deep rock behaviour in engineering environment**

Recent advanced project studies constructed in deep rocks, New advanced techniques used to improve the strength and stability of rocks.

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i) Fundamentals of Rock Mechanics *By Ömer Aydan ISBN*

ii) Fundamentals of Rock Mechanics" by J C Jaeger and N G W Cook

iii) "Fundamentals and Applications of Rock Mechanics" by Deb Debasis and Verma Abhiram Kumar.

iv)"Engineering Rock Mechanics" by John A Hudson

1. Name of the Department: Civil Engineering Department						
2. Course Name	Engineering Behavior of Rocks Lab	L	T		P	
3. Course Code		3	0		2	
4. Type of Course (use tick mark)		Core ()	PE-III(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =00		**Tutorials =0**	**Practical =28**			

8. Brief Syllabus

Syllabus of engineering behavior of rocks including brief study of rocks,minerals,identifaction procedures for rocks and minerals, representation of geological data, testing and identification of rocks, rocks failure theories and rock stability methods.

9. Learning objectives:

This subject is taught to impart knowledge the mechanical behaviour of rocks, based firmly upon experimental data, which can be used to explain how rocks deform, fracture and yield, and to show how this knowledge can be used in design.

10. Course Outcomes (COs):

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

1- Identify and analysis the properties of minerals and rocks

2- Understand the representation of geological and geographic data

3- Determine the engineering properties of rocks

4-Understand and analysis the difficulties comes in engineering projects when founded on deep rock strata and recent techniques to improve the stability of different types of rocks.

11. Unit wise Detailed Lab content

1- To study identification procedures of minerals

2- To study identification procedures of various rocks

3- Analysis of Spherical Representation of geological data

4- Brazilian Test

5- Rebound Hardness Test

6- Free Swell Test & Void Index Test

7- Industrial visits to analysis the structure of various rocks

1. Name of the Department: Civil Engineering Department						
2. Course Name	Green Building Methodology	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core (✔)	PE-XV()		OE()	
5. Pre-requisite (if any)	Nil	6. Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life.

9. Learning objectives:

1. To study about the concepts of green building and low energy approaches.
2. To get a thorough knowledge about Green building systems, auditing and energy management.
3. Recognize and demonstrate methods for green project management, certification registration and documentation and green rating system compliance.

10. Course Outcomes (COs):

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

1. Understand the concepts and factors influencing green building concepts, systems and energy management
2. Impact of indoor environmental quality on occupant well-being and comfort relevant to 21st century in India
3. Identify and compare existing energy codes, green building codes and green rating systems.
4. Study about the fundamentals of energy and energy production systems pertaining to Residential, Commercial, Institutional and Public Buildings.
5. Use low embodied energy industrial and building materials and cost effective building technologies

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit:** Introduction

Green Composites for buildings - Concepts of Green Composites - Water Utilization in Buildings, Low Energy Approaches to Water Management - Management of Solid Wastes , Sullage Water and Sewage - Urban Environment and Green Buildings - Green Cover and Built Environment.

Unit – 2	Number of lectures = 10	Title of the unit: Green Building Systems
Comfort in Building, Thermal Comfort in Buildings- Issues, Heat Transfer Characteristic of Building Materials and construction techniques , Incidence of Solar Heat on Buildings-Implications of Geographical Location- Green management in India - relevance in twenty first century.		
Unit – 3	**Number of lectures = 10**	**Title of the unit:** Green Building Auditing
Environmental reporting and ISO 14001,Climate change business and ISO 14064 , Energy and resource conservation-Principles, Design of green buildings-rating systems-LEED Standards – Indian green building council rating system for various types of projects.		
Unit – 4	**Number of lectures = 12**	**Title of the unit:** Energy
Fundamentals of Energy - Energy production systems - Heating, Ventilating and Air conditioning - Solar Energy - Energy Economic Analysis - Energy Conservation and Audits - Domestic Energy Consumption - Savings - Primary Energy use in Buildings – Residential - Commercial - Institutional and Public Buildings.		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Osman Attmann, (2010), "Green Architecture Advanced Technologies and Materials". McGraw Hill.
2. Md. Zakiur Rahman, Most. Sharmin Islam, Md. Shahedur Rashid, (2012) "Practice of Green Building Technologies and Water Conservation Process" LAP Lambert Academic Publishing.
3. Sam Kubba, (2012), "Handbook of Green Building Design and Construction: LEED, BREEAM, and Green Globes" Elsevier Science.

1. Name of the Department	**CIVIL ENGINEERING**					
2. Subject Name	**Green Building methodology Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE ()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 00	**Tutorials = 00**	**Practical = 28**

7. Learning objectives:

1. To study about the concepts of green building and low energy approaches.
2. To get a thorough knowledge about Green building systems, auditing and energy management.
3. Recognize and demonstrate methods for green project management, certification registration and documentation and green rating system compliance.

8. Course Outcomes (COs):

At the end of the lab course student able to

1. Understand the concepts and factors influencing green building concepts, systems and energy management
2. Impact of indoor environmental quality on occupant well-being and comfort relevant to 21st century in India
3. Identify and compare existing energy codes, green building codes and green rating systems.
4. Study about the fundamentals of energy and energy production systems pertaining to Residential, Commercial, Institutional and Public Buildings.

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Case study selection of Building
2	Data collection for structure
3	Project descriptions for case studies
4	Case comparison was performed according to LEED's Sustainable Sites
5	Case comparison was performed according to LEED's Water Efficiency
6	Case comparison was performed according to LEED's Energy

1. Name of the Department: Civil Engineering						
2. Course Name	Solid Waste Management	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		**Core ()**	**PE(✔)**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

8. Brief Syllabus

This course is based on Solid-waste management techniques**,** the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

9. Learning Objectives:

1. To gain insight into collection, transfer and transport of municipal solid waste.
2. Understand the design and operation of municipal solid waste landfill.
3. Understand the design and operation of resource recovery facility.
4. Understand the design and operation of waste to energy facility.

10. Course Outcomes (COs):

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

1. Understand solid waste and its composition
2. Understand various processes involved in solid waste collection, segregation and transportation.
3. Design solid waste disposal facility
4. Able to handle leachate in preventing ground water pollution.
5. Apply the understanding in disposal of Solid Wastes.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Municipal Solid Waste Management**

Definition of solid waste–waste generation, major legislation, monitoring responsibilities, sources and types of solid waste, sampling and characterization, Determination of composition of MSW–storage and handling of solid waste. Future changes in waste composition.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Collection and Transportation of Solid Waste**

Waste collection systems, analysis of collection system–alternative techniques for collection system. Need for transfer operation, transport means and methods, transfer station types and design requirements.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Process of Solid Waste and Energy recovery**
Unit Operations for separation and processing, Materials Recovery facilities, Waste transformation through combustion and aerobic composting, anaerobic methods for materials recovery and treatment, Energy Recovery-Incinerators		
Unit - 4	**Number of lectures = 8**	**Title of the unit: Landfills & Disposal of Solid Wastes**
Landfills: Site selection, Engineered Sites, liners and covers, leachate control and treatment, gas recovery and control, including utilization of recovered gas (energy). Landfill monitoring and reclamation. Definition and identification of hazardous wastes-sources and characteristics, hazardous wastes in Municipal Waste, Hazardous waste regulations – minimization of Hazardous Waste-compatibility, handling, storage and disposal of hazardous waste-collection and transport. Exposure to applications based on current industrial trends.		

11. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Hand book of Solid Waste Management by Frank Kreith, McGraw Hill Publication.
2. Bagchi, A., Design, Construction, and Monitoring of Landfills, (2ndEd). Wiley Interscience, 1994.
3. Sharma, H. D., and Lewis, S. P., Waste Containment Systems, Waste Stabilization and Landfill. Design and Evaluation. Wiley Interscience, 1994. ISBN: 0471575364.
4. George Techobanoglous et al," Integrated Solid Waste Management ", McGraw-Hill Publication, 1993.
5. Charles A. Wentz; "Hazardous Waste Management ", McGraw-Hill Publication, 1995

1. Name of the Department: Civil Engineering						
2. Course Name	Solid Waste Management Lab	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward Solid Waste Management methods. In addition to that, this course will inculcate the understanding about parameters involved in Solid Waste Management analysis.

8. Learning objectives:

1. Understand the processes for determination of Solid Waste Management parameters.
2. To gain insight into basic concept Solid Waste Management Processes.
3. Understand the parameters involved in determination of Solid Waste Management Processes.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of Solid Waste Management.

2. Apply the understanding of analytical techniques toward parameters that influences Solid Waste Management.

8. Unit-wise detailed content

1. Determination of solids content in waste water.
2. Determination of acidity and alkalinity of a given solution.
3. Estimation of Turbidity level in a given sample.
4. Test for Residual Chlorine.
5. Determination of Oil and Grease.
6. Determination of Optimum Coagulant dosage.
7. Determination of suspended, settleable, volatile and fixed solids
8. Determination of Total and Volatile Sludge Solids.
9. Determination of Iron and Manganese in Water.
10. Determination of Sulphate and Sulphide in Water.

Departmental Elective - IV

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Water Resource System Planning**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem (√)	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

The main sources of water supply are surface and ground water which have been used for a variety of purposes such as drinking, irrigation, hydroelectric energy, transport, recreation etc. Often, human activities are based on the „usual or normal" range of river flow conditions. However, flows and storage vary spatially and temporally; and also they are finite (limited) in nature i.e., there is a limit to the services that can be expected from these resources.

8. Learning objectives:

1) To introduce the student to the concept of Mathematical approaches for managing the water resources system.
2) To make the students apply an appropriate system approach to optimally operate a water resource system.

9. Subject Outcomes:

Students will be able to understand :-

1) Learn how to analyze water reservoir systems under multiple objectives using simulation modeling, stochastic hydrology, and scenario analysis.

2) Master techniques of classical and evolutionary-algorithm based optimization.

3) Consider uncertainties such as socioeconomic factors, climate change, and regulatory constraints and their impact on water resources planning and management.

4) Use River Ware as well as other computational techniques including spreadsheets and computer programming to solve water resources planning and management problems

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Introduction and basic concepts, Systems components, Planning management, Modelling of Water Resource System, Optimization.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Optimization**

Objectives, Function, Maxima , Minima, Saddle Points, Convexity & Concavity, Constrained & Unconstrained Optimization

Unit - 3	Number of lectures = 10	Title of the unit: Linear Programming and Applications
Preliminaries, Graphical method, Simplex Method –I, Simplex Method-II, Linear Programming Application, Reservoir Operation and Reservoir sizing using LP		
Unit - 4	**Number of lectures = 10**	**Title of the unit: Dynamic Programming and Applications**
Introduction and preliminaries, Water Allocation, Capacity Expansion, Reservoir Operation, Multipurpose reservoir operation, Weighting Function and Constraint Method.		

11. Books Recommended

Text Books

1.Vedula, S., and Majumdar, P.P. "Water Resources Systems" – Modeling Techniques and Analysis Tata McGraw Hill, 5th reprint, New Delhi, 2010.

References

1. 1. Hall Warren, A. and John A. Dracup., "Water Resources System Engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998
2. Chadurvedi M.C., "Water resource Systems Planning and Management", Tata McGraw Hill inc., New Delhi,1997
3. Taha H.A., "Operation Research", McMillan Publication Co., New York, 1995.

1. Name of the Department	**CIVIL ENGINEERING**					
2. Subject Name	**Water Resource System Planning Lab**	**L**	**T**	**P**		
3. Subject Code		0	0	4		
4. Type of Subject		Core ()	PE-()	OE()		
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Learning objectives:

1) To introduce the student to the concept of Mathematical approaches for managing the water resources system.
2) To make the students apply an appropriate system approach to optimally operate a water resource system.

8. Course Outcomes (COs):

At the end of the lab course student able to

Students will be able to understand :-

1) Learn how to analyze water reservoir systems under multiple objectives using simulation modeling, stochastic hydrology, and scenario analysis.

2) Master techniques of classical and evolutionary-algorithm based optimization.

3) Consider uncertainties such as socioeconomic factors, climate change, and regulatory constraints and their impact on water resources planning and management.

4) Use River Ware as well as other computational techniques including spreadsheets and computer programming to solve water resources planning and management problems

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	Title
1	Systems components
2	Convexity & Concavity
3	Constrained & Unconstrained Optimization
4	Graphical method, Simplex Method
5	Linear Programming Application
6	Introduction and preliminaries
7	Weighting Function and Constraint Method

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Environmental Geotechnology**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem (√)	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

Environmental issues and sustainable development have received major attention from all countries in recent years. Agenda 21, the action plan from the Earth Summit, which took place in Rio de Janeiro in June 1992 (UNCED, 1993) indicated the essential role which engineers have to play in the achievement of sustainability and protection of the environment.

8. Learning objectives:

The courses discusses the following in detail:-

1. Concepts and principles of Geo environmental Engineering.
2. Geotechnical aspects of planning and design of MSW and Hazardous waste Landfills.
3. Geotechnical aspects of planning and design of slurry ponds - ash ponds and tailing ponds.
4. Geotechnical aspects of detection & monitoring of subsurface contamination and control & remediation of contaminated sites

10. Subject Outcomes:

Students will be able to understand :-

1) Learn how to analyze water reservoir systems under multiple objectives using simulation modeling, stochastic hydrology, and scenario analysis.

2) Master techniques of classical and evolutionary-algorithm based optimization.

3) Consider uncertainties such as socioeconomic factors, climate change, and regulatory constraints and their impact on water resources planning and management.

4) Use River Ware as well as other computational techniques including spreadsheets and computer programming to solve water resources planning and management problems.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Environmental cycles - Soil and water - Environmental interaction relating to geotechnical problems - Effect of pollution on soil - water behaviour.

Origin, nature and distribution of soil - Description of individual particle - Soil fabric and structure - Gravitational and surface forces - Intersheet and interlayer bonding in the clay minerals - Basic structural units of clay minerals - Isomorphous substitution - Kaolinite mineral - Montmorillonite mineral - Illite mineral - Electric charges on clay minerals - Ion exchange capacity - Diffused double layer - Adsorbed water - Soil structure - Methods for the identification of minerals **(Introduction**

only)

Unit - 2	**Number of lectures = 10**	**Title of the unit: Types and composition**

Sources, types and composition of different wastes - Characteristics and classification of hazardous wastes - Generation rates - Potential problems in soils due to contaminants.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Ground modification**

Ground modification and waste modification techniques in waste management - Ground modification - Mechanical modification, hydraulic modification, and chemical modification.

Unit - 4	**Number of lectures = 12**	**Title of the unit: Liners and covers for waste disposal**

Liners and covers for waste disposal - rigid and flexible liners - Leachate and gas collection system - Engineered landfills (including basal liner and cover liner systems) – components - design criteria. Hydrological design for ground water pollution control.

11. Books Recommended

Text Books

1.Vedula, S., and Majumdar, P.P. "Water Resources Systems" – Modeling Techniques and Analysis Tata McGraw Hill, 5th reprint, New Delhi, 2010.

References

4. 1. Hall Warren, A. and John A. Dracup., "Water Resources System Engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998
5. Chadurvedi M.C., "Water resource Systems Planning and Management", Tata McGraw Hill inc., New Delhi,1997
6. Taha H.A., "Operation Research", McMillan Publication Co., New York, 1995.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Environmental Geotechnology Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Learning objectives:

The courses discusses the following in detail:-

1. Concepts and principles of Geo environmental Engineering.
2. Geotechnical aspects of planning and design of MSW and Hazardous waste Landfills.
3. Geotechnical aspects of planning and design of slurry ponds - ash ponds and tailing ponds.
4. Geotechnical aspects of detection & monitoring of subsurface contamination and control & remediation of contaminated sites.

8. Course Outcomes (COs):

At the end of the lab course student able to

1) Learn how to analyze water reservoir systems under multiple objectives using simulation modeling, stochastic hydrology, and scenario analysis.

2) Master techniques of classical and evolutionary-algorithm based optimization.

3) Consider uncertainties such as socioeconomic factors, climate change, and regulatory constraints and their impact on water resources planning and management.

4) Use River Ware as well as other computational techniques including spreadsheets and computer programming to solve water resources planning and management problems.

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Environmental interaction relating to geotechnical problems
2	Intersheet and interlayer bonding in the clay minerals
3	Methods for the identification of minerals
4	Characteristics and classification of hazardous wastes
5	Potential problems in soils due to contaminants.
6	Ground modification and waste modification techniques in waste management
7	Liners and covers for waste disposal
8	Design Criteria: - Hydrological design for ground water pollution control.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Quality and safety Practices in construction**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem (√)	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

The fundamental reason for the course is to impart knowledge and skill for the construction students to achieve success in quality management system (QMS) by understanding and evaluating quality management principles as a formalized system that has documents, processes, procedures, and authorities, responsibilities and for achieving quality policies and objectives.

8. Learning objectives:

1) Understand and evaluate the definitions and objectives of quality management principles in construction sector and factors influencing construction such as quality plans and quality circle

2) Understand and evaluate authorities and responsibilities of QMS and Quality Management Guidelines.

9. Subject Outcomes:

I. Understand and evaluate quality management principles and best practices in construction. Students must understand environmental impact assessment (EIA)for construction projects towards quality; Students must understand social impact assessment (EIA) for construction projects towards quality;

2. Understand and evaluate safety management principles in construction;

3. Understand and analyze quality circle (QC) concepts for possible implementation to solve construction productivity and quality problems entitled “How to manage productivity quality?

4. Good basic practices for quality system and progress for quality assurance and quality improvement for construction companies.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Quality management**

Introduction – Definitions and objectives – Factors influencing construction quality – Responsibilities and authority – Quality plan – Quality Management Guidelines – Quality circles

Unit - 2	**Number of lectures = 10**	**Title of the unit: Quality planning**

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi’s concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures -Processes and products – Total QA / QC programme and cost implication.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Quality assurance and quality improvement techniques**

Objectives – Regularity agent, owner, design, contract and construction oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals, Factors influencing construction quality – Critical, major failure aspects and failure mode analysis

Unit - 4	**Number of lectures = 12**	**Title of the unit: Safety management systems**

Fundamental of safety management, construction safety, safety in scaffolding and working platform, welding and handling, excavation work, concreting and cementing work. Building construction, TAC and NBC rules, High rise building. Evolution of modern safety concept- Safety policy - Safety Organization. Safety survey, safety inspection, safety sampling, Safety Audit

11. Books Recommended

Text Books

Introduction to Transportation Planning – M.J.Bruton; Hutchinson of London Ltd

References

1. Introduction to Urban System Planning - B.G.Hutchinson; Mc Graw Hill.
2. Traffic Engineering and Transport Planning - Kadiyali L.R., Khanna Publishers

1. Name of the Department	**CIVIL ENGINEERING**					
2. Subject Name	**Quality and safety Practices in construction Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 00	**Tutorials = 00**	**Practical = 28**

7. Learning objectives:

1) Understand and evaluate the definitions and objectives of quality management principles in construction sector and factors influencing construction such as quality plans and quality circle

2) Understand and evaluate authorities and responsibilities of QMS and Quality Management Guidelines.

8. Course Outcomes (COs):

At the end of the lab course student able to

1. Understand and evaluate quality management principles and best practices in construction.
2. Students must understand environmental impact assessment (EIA)for construction projects towards quality
3. Understand and evaluate safety management principles in construction; .
4. Understand and analyze quality circle (QC) concepts for possible implementation to solve construction productivity and quality problems entitled “How to manage productivity quality?
5. Good basic practices for quality system and progress for quality assurance and quality improvement for construction companies

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Statistical evaluation based on field tests.
2	Quality system document reports in an ongoing construction project
3	Preparation of control charts and sampling criteria for materials.
4	Prepare life cycle costing for a construction project.
5	Safety training and implementation at site
6	Factory Act-Laws related to the Industrial Safety.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Geodesy and GPS Surveying	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		**Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus: The history of geodesy including measurement techniques, coordinate systems, ellipsoids, and datum's is reviewed. The modern geodetic and Cartesian coordinates systems, as well as the differences between grid and ground coordinates systems, and the current geodetic and Cartesian coordinate systems available today are discussed.

8. Learning objectives:

1) The concepts of a datum, a projection, and a geoids model.
2) Will be able to select an appropriate projection and couple it with a geoids model to present data collected using GPS in a Cartesian coordinate system.

9. Course Outcomes:

On completion of the class the student will understand

1) The concepts of a datum, a projection, and a geoids model.
2) Will be able to select an appropriate projection and couple it with a geoids model to present data collected using GPS in a Cartesian coordinate system.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit : GNSS Basic Observables**

Pseudo ranges and carrier phase measurements.

Unit-2	**Number of lectures = 10**	**Title of the unit: GNSS Surveying Techniques**

Point positioning and differential positioning, DGPS and SBAS. Relative positioning: Static – Rapid static and pseudo kinematic; kinematic positioning – pure kinematic, semi kinematic and real time kinematic (RTK) methods of observations. Real time network (VRS) services.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Planning and field observations**

Networking, data post processing; with vendor software and scientific software. CORS, setting up of regional geodetic networks and development of regional geoid models.

Unit - 4	**Number of lectures =10**	**Title of the unit: GNSS applications to Global, Regional and Local issues**

IUGG, IAG, IGS and IERS services.

11. Brief Description of self learning / E-learning component

1. https://swayam.gov.in/course/3697-GeodesyandGPSSurveying

12. Books Recommended

TEXTBOOKS :

- Basic GIS Coordinates(Second Edition), Jan Van Sickle
- Kaplan, E D and Hegarty C J (2006). Understanding GPS: Principles and Application. 2nd ed. Artech House Inc., MA 02062.
- Alfred Leick (2004). GPS Satellite Surveying. 3rd ed. John Wiley and Sons Inc.,

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Geodesy and GPS Surveying Lab	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		✓ **Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	✓ Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures =		**Tutorials = 00**	**Practical = 28**			

Brief Syllabus: The history of geodesy including measurement techniques, coordinate systems, ellipsoids, and datum's is reviewed. The modern geodetic and Cartesian coordinates systems, as well as the differences between grid and ground coordinates systems, and the current geodetic and Cartesian coordinate systems available today are discussed.

8. Learning objectives:

1) The concepts of a datum, a projection, and a geoids model.
2) Will be able to select an appropriate projection and couple it with a geoids model to present data collected using GPS in a Cartesian coordinate system.

9. Course Outcomes:

On completion of the class the student will understand

5. The concepts of a datum, a projection, and a geoids model.
6. Will be able to select an appropriate projection and couple it with a geoids model to present data collected using GPS in a Cartesian coordinate system.

10. Unit wise detailed content

1) History of determining the shape and size of the earth
2) History of Coordinate Systems, Ellipsoids and Datums
3) Cartesian Vs. Geodetic Coordinates
4) Differences between Geodetic, Geographic, and Astronomic Coordinates
5) Relating ECEF Cartesian Coordinates with Geodetic Coordinates
6) Datums: Horizontal Vs. Vertical Datums (NAD 83 Vs. NAVD88)
7) Grid Distances Vs. Ground Distances

1. Name of the Department: Civil Engineering						
2. Subject Name	Natural Disaster Mitigation and Management	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 00**			

7. Brief Syllabus:

This course will cover the influences of the human beings on the natural processes and by the implication on load on the environment, natural disasters are common in the today's world. Students learn natural disasters around the world and risk assessment, disaster mitigation, preparedness, response and recovery, earthquake, geological, geo-morphological aspects, landslides, severe weather & tornadoes, cyclones, floods and droughts. Upon completion, students should be able to Map, conduct modeling, risk analysis and loss estimation, natural disaster risk analysis and apply prevention and mitigation measures to reduce the impacts.

8. Learning objectives:

1. To understand the aspects of Natural Disaster and its causes.
2. To know about the various disasters such as Drought, Famine, Flood etc.
3. To understand mitigation ways and understand the early warning system working in disastrous conditions.
4. To understand the role of Humans in Global Phenomena such as Global Warming.
5. To Understand the role of International Organization and NGO;s in disaster management.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Identify the natural and environmental disasters, its causes and apply preventive measures.
2. Know about the organizational and administrative strategies for managing disasters.
3. Understand the working of early warning systems, monitoring of disasters effect and necessity of rehabilitation.
4. Able to work on engineering and non-engineering controls of mitigating various natural disasters.
5. Learn methodologies for disaster risk assessment with the help of latest tools like GPS, GIS, Remote sensing, information technologies, etc.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Natural Disasters – Overview**

Introduction- Natural Disasters around the world, Need of Natural Disaster Risk Assessment, Environmental Change and Degradation: Global warming, Human Dimensions of Global environment Change, Disaster mitigation, preparedness, response and recovery-comprehensive emergency management, Early warning systems and Disaster Preparedness-Rehabilitation, Food, Nutrition and Shelter-Role of UN Red cross and NGOs

Unit - 2	**Number of**	**Title of the unit: Earthquakes & Oceanic Phenomena**

	lectures = 12	
Introduction to Natural Disasters- Principles, Geo-morphological aspects-Earthquake, Seismology, Characteristics, Landslides- Human impact on the mountainous terrain and its relationship with Rainfall, Tsunami-Nature and characteristics, Tides.		
Unit - 3	**Number of lectures = 12**	**Title of the unit: Critical Climate System aspects and Processes**
Hydrologic cycles, Tornadoes, Cyclones, Floods and Droughts, Mitigation & Preparation-Drought & Famine, Drought & Famine Assessment & Monitoring Methods.		
Unit - 4	**Number of lectures = 8**	**Title of the unit: Natural hazards Assessment and Communication Administrative mechanisms**
Natural disaster Risk Analysis-prevention and mitigation, Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems, Disaster Monitoring and Support Centre– Information Dissemination-Mobile Communications etc. Role of Education and Training-Use of Multi-media knowledge products for self-education for prevention of Natural Disaster. Exposure to applications based on current industrial trends.		
11. Books Recommended (3 Text Books + 2-3 Reference Books)		
1. Edward A Keller, Robert H Blodgett (2007), Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, Pearson Prentice Hall, 2nd Edition.		
2. Edward Bryant (2005), Natural Hazards, Cambridge University Press, New York.		
3. Robert L Kovach Earth's Fury (1995), An Introduction to Natural Hazards and Disasters, Prentice Hall.		
4. Davi Alexander (1993), Natural Disasters, Routledge.		
5. Disaster Management and Mitigation, by Prof. R.B. Singh, World Focus (1 January 2016)		

1. Name of the Department: Civil Engineering						
2. Course Name	Natural Disaster Mitigation and Management Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward Natural Disaster Mitigation and Management methods. In addition to that, this course will inculcate the understanding about parameters involved in Natural Disaster Mitigation and Management.

8. Learning objectives:

1. Understand the processes for determination of Natural Disaster Mitigation and Management parameters.
2. To gain insight into basic concept Natural Disaster Mitigation and Management.
3. Understand the parameters involved in determination of Mitigation.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of Natural Disaster Mitigation and Management.

2. Apply the understanding of analytical techniques toward parameters that influences Natural Disaster Mitigation and Management.

8. Unit-wise detailed content

1. Determination of Moisture Content.
2. Determination of Specific Gravity.
3. Determination of Grain size distribution of the soil by Sieve Analysis.
4. Determination of Optimum moisture content and maximum dry density of soil by Proctor Test.
5. Determination of Shear Strength Parameters of soil by Direct Shear Test.
6. Standard Penetration Test.
7. Determination of Relative Density.
8. To demonstrate the Disaster Causes in Mountain sites
9. To demonstrate the flood causing factors in Bihar, Kosi river.
10. To demonstrate the disastrous effect of tsunami.

5th Semester

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Highway Engineering**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Surveying	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials =**	**Practical**			

7. Brief Syllabus:

Highway Engineering is a prominent aspect of surface transport. Highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students will learn about the highway related tests on Soil, Bitumen and Aggregate. Students will also get familiar with the test on Modified Binder and modern techniques of highway construction along with use of modern highway construction materials. Course shall also contain design of Highway Engineering.

8. Learning objectives:

1. To impart the knowledge of various geometric elements of highway design
2. To impart the knowledge of the highway construction materials.
3. To impart the knowledge of the design methods for flexible and rigid pavement.

9. Subject Outcomes:

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

1. Design various geometric elements of highways.
2. Understand the various types of materials used in highway construction along with conducting specified test on the materials as per BSI code for their suitability.
3. Perform structural design of flexible and rigid pavements.
4. Know various highway constructions techniques and its maintenance

10. Unit wise detailed content

Unit-1	**Number of lectures = 12**	**Title of the unit: Cross sectional elements and sight distances**

Introduction to Transportation Engineering and modes of Transportation, Types of engineering surveys for highway alignment, Classification of roads.

Cross sectional elements, Sight Distances: Stopping, Overtaking, Decision and Headlight Sight Distance studies.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Curve/Alignment Design**

Geometric design of horizontal and vertical alignment; Horizontal curve design; Super Elevation, Extra widening, Transition curves; Set back distance; Vertical curves design, design of highways/expressways.

Unit - 3	**Number of lectures = 08**	**Title of the unit: Basics of Traffic Engineering**
Introduction, Traffic Characteristics, Traffic study and analysis: Traffic volume study, Traffic speed study, Traffic flow characteristics, Traffic Intersection design.		
Unit - 4	**Number of lectures = 10**	**Title of the unit: Pavement Materials**
Pavement materials – soil, aggregate, bitumen (including modified one), cement and unconventional materials- shell and block; Pavement material testing and specification. Design of flexible and rigid pavement.		

11. Books Recommended

Text Books

S.K. Khanna, C.E.G. Justo & A. Veeragavan (2014),10th Edition, ISBN No. 978-81-85-240-72-05, Highway Engineering, Nem Chand and Bros

References

1. S.C. Rangwala, Highway Engineering.
2. Roger L. Brockenbrough, Highway Engineering Handbook

1. Name of the Department: Civil Engineering Department						
2. Course Name	Highway Engineering Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core (√)	**PE()**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials =0**	**Practical =28**			

7. Brief Syllabus:

Highway Engineering is a prominent aspect of surface transport. Highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students will learn about the highway related tests on Soil, Bitumen and Aggregate. Students will also get familiar with the test on Modified Binder and modern techniques of highway construction along with use of modern highway construction materials. Course shall also contain design of Highway Engineering.

8. Learning objectives:

1. To impart the knowledge in Highway materials.
2. Perform the various tests on aggregates.
3. Perform the various tests on bitumen.
4. Understand and analyze test data for pavement design.

7. Course Outcomes (COs):

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

1. Design various geometric elements of highways.
2. Understand the various type of materials used in highway construction along with conducting specified test on the materials as per BSI code for their suitability.
3. Perform structural design of flexible and rigid pavements.

8. Unit wise detailed content

1. Aggregate Impact Test.
2. Los-Angeles Abrasion Test on Aggregates.
3. Dorry's Abrasion Test on Aggregates.
4. Deval Attrition Test on Aggregates.
5. Crushing Strength Test on Aggregates
6. Penetration Index Test on Bitumen
7. Ductility Test on Bitumen.
8. Viscosity Test on Bituminous Material.
9. Flash and Fire Point Test on Bitumen

10. Flakiness and elongation test

11. Marshal Stability test

12. C B R Value test.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Reinforced concrete Structure**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	BMC	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures =42		**Tutorials = 00**	**Practical**			

7. Brief Syllabus:

Students will learn the concept of working stress method and limit state method for various reinforced concrete sections. Students will also learn the concept of design of one way, two way and circular slabs, short column and long column, axially and eccentrically loaded columns. Students will understand the concept of footings and retaining wall design as well.

8. Learning objectives:

1. To teach the students about the design of reinforced concrete beam, column, slab, footing and retaining wall.
2. To enable the students to understand the various design philosophies based on both working stress and limit state methods.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Understand the behavior of structural members and the concept of RCC design.
2. Calculate the load carrying capacity of different types of RCC structural members for Civil Projects.
3. Design the safe RCC structural members keeping serviceability criteria in view.
4. Students will be made familiar with the BIS codes for structural design.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Design of Beam (Working Stress Method)**

Basic assumptions, permissible stresses in concrete and steel, design of singly and doubly reinforced rectangular, T shaped beams in flexure.

Design of Sections in shear, bond and torsion, diagonal tension, shear reinforcement, development length, equivalent shear, Tensional reinforcement.

Unit - 2	**Number of lectures = 09**	**Title of the unit: Design of Beam (Limit State Method)**

Introduction to Limit state method, basic assumptions, design of singly and doubly reinforced rectangular, T shaped beams and inverted beam in flexure, minimum and maximum reinforcement requirement.

Design of Sections in shear, bond and torsion, diagonal tension, shear reinforcement, development length, equivalent shear, Tensional reinforcement.

Unit - 3	Number of lectures = 08	Title of the unit: Design of Slab
Introduction to one-way and two-way slab, design of slab by working stress method and limit state method, design of circular slab supported on edges and with centrally supported slab. Design of canopy.		
Unit – 4	**Number of lectures = 08**	**Title of the unit: Deign of Column and Foundation**
Design of short and slender columns by Limit State Method for axial load and combination of uniaxial and biaxial bending. Design of column with helical reinforcement, Introduction to types of foundations, design of isolated footing, continuous footing and combined footing. Design of RCC footing for walls. Isolated footing subjected to eccentric load. Introduction to type of retaining walls.		

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1 RCC Designs, B.C Punmia (2012),10th Edition, ISBN No. 978-81-318-0942-6, Laxmi Publications

Reference books

1. IS-456-2000.
2. SP-16(S&T)-1980, Design Aids for Reinforced Concrete to IS: 456, BIS, N.Delhi.
3. SP-34(S&T)-1987 Handbook on Concrete Reinforcement and Detailing`, BIS
4. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros., Roorkee.
5. Reinforced Concrete, I.C.Syal & A,K, Goel, A.H, Wheeler & Co. Delhi.
6. Reinforced Concrete Design, S.N.Sinha, TMH Pub., and N.Delhi.

Departmental Electives –V

Sr. No	Specialization	Departmental Elective-V	Departmental Elective-VI	Departmental Elective-VII	Departmental Elective-VIII
1	**Water Resource Engineering**	Watershed Management	Environmental Impact Assessment and Management	Principles of Geomatics	Urban Water Management
2	**Geotechnical Engineering**	Advanced Soil Mechanics	Geotechnology	Rock Mechanics	Geotechnical Earthquake Engineering
3	**Structural Engineering**	Advanced Structural Analysis	Energy Efficient Structures	Reinforced Concrete Structures-II	Bridge engineering
4	**Construction Management**	Project Planning and Management	Quantitative Methods in Construction Managements	Contract Laws & Regulations	Concrete Construction Technology
5	**Geo-Informatics and Remote Sensing**	Analytical and Digital Photogrammetry	Advanced Digital Image Processing	Thermal, Microwave and Hyper spectral Remote Sensing	Theory and Applications of GIS
6	**Environmental Engineering**	Earth and Environment	Environmental Remote Sensing	Disaster Management	Environment Impact Assessment
7	**Transportation Engineering**	-	-	Railway and Tunnel Engineering	Airport Planning and Design

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Watershed management**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures =42		**Tutorials = 00**	**Practical = 00**			

7. Learning objectives:

1. Proper use of all available resources of a watershed for optimum production with minimum hazards to natural resources.
2. Discuss various aspects of water resources development and management on watershed basis.

8. Subject Outcomes: On completion of this course, the students will be able to

1. Apply their knowledge of Watershed management practices in various regions; Sustainable watershed approach; Integrated watershed management; Watershed modeling; Use of modern techniques in watershed management;
2. Apply social aspects of watershed management; Management of water quality; Storm water and flood management; Drought management; Water conservation and recycling.

9. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction and Basic Concepts:**

Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Sustainable Watershed Approach & Watershed Management Practices:**

Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation; Watershed Management Practices in Arid and Semiarid Regions, Case studies, short term and long term strategic planning.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Integrated Watershed Management:**

Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system.

Unit – 4	**Number of lectures = 12**	**Title of the unit: Watershed Modeling:**

Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-runoff process, subsurface flows and groundwater flow.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Murty, J.V.S. "Watershed Management", New Age Intl., New Delhi 1998

2. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Watershed management Laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials =0**	**Practical =0**			

7. Learning objectives:

1. Proper use of all available resources of a watershed for optimum production with minimum hazards to natural resources
2. Discuss various aspects of water resources development and management on watershed basis.

8. Subject Outcomes: On completion of this course, the students will be able to

1. Apply their knowledge of Watershed management practices in various regions; Sustainable watershed approach; Integrated watershed management; Watershed modeling; Use of modern techniques in watershed management;
2. Apply social aspects of watershed management; Management of water quality; Storm water and flood management; Drought management; Water conservation and recycling.

9. Unit wise detailed content

1. Examine various stakeholders in watershed management.
2. Explore nearby natural resources for their effects in watershed.
3. Study the nearby arid and semi-arid areas for watershed management.
4. Explore the possibility of building a rainwater harvesting plants in nearby areas.
5. Examine the role of integrated watershed management.
6. Study various steps in watershed modelling

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Advanced Soil Mechanics**	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core (✔)	PE()		OE()	
5. Pre-requisite (if any)	Soil Mechanics	**6.** Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

Students will understand the advanced concept of soil mechanics which includes soil properties, effective stresses acting on soil, consolidation behavior of soil and strength characteristics of different types of saturated and unsaturated soil.

9. Learning objectives:

1. To study the advanced methods of determination of engineering properties of different soil samples.
2. To lay a firm theoretical background necessary in the design of geotechnical systems
3. Estimates shear strength, consolidation and effective stress of saturated, unsaturated and partially saturated soils.

10. Course Outcomes (COs):

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

1. Students are able to calculate effective stresses of soil
2. Determine the rate and magnitude of soil consolidation when the soil is restrained laterally and loaded axially.
3. Using shear strength concepts students able to design structures generally fail in shear
4. Analyze the results of shear strength in case of saturated soil and unsaturated soil.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Soil-water interaction**

Effective Stress: The principle of effective stress, Inter-granular pressure, Pore pressure, capillary pressure, problems.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Compressibility and Consolidation**

Consolidation: Principle of consolidation-compressibility, pressure-void ratio relationships, Terzaghi's one dimensional consolidation parameters, pre-consolidation pressure, Estimation of total Settlement. Two- and three-dimensional consolidation, Secondary compression.

Unit – 3	Number of lectures =10	Title of the unit: Strength behaviour of soil
Shear Strength: Basic concepts, Mohr-Coulomb theory; measurement of shear strength, drainage conditions, stress paths, pore pressure parameters. Interpretation of triaxial test results.		
Unit – 4	**Number of lectures = 12**	**Title of the unit: Strength of Cohesion less and saturated cohesive Soils**
Strength of Cohesion less Soils: Friction between solid surfaces, Frictional behaviour of minerals, strength of granular soil, Factors affecting strength and deformation, Dilatancy, critical void ratio, Liquefaction. **Strength of Saturated Cohesive Soils:** Effective stress-water content relationship, stress history, structure, strain rate, sensitivity, Thixotropy, Hvorslev's strength parameters.		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i) Atkinson, J.H. and Bransby, P.L, The Mechanics of Soils: An introduction to Critical soil mechanics, McGraw Hill, 1978.

ii) R.D. Holtz & W.D. Kovacs, "An Introduction to Geotechnical Engineering" – Prentice – Hall India, 1981.

iii) J. K. Mitchel, "Fundamentals of Soil behaviour" - John Wiley & Sons, 1993.

iv) T. W. Lambe & R. V. Whitman, "Soil Mechanics" - Wiley Eastern Ltd.,2000

v) Terzaghi, K., and Peck, R.B., Soil Mechanics in Engineering Practice, John Wiley & Sons, 2013.

1. Name of the Department: Civil Engineering Department						
2. Course Name	Advanced Soil Mechanics Laboratory	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	PE (✔)		OE()	
5. Pre-requisite (if any)	Soil mechanics	**6.** Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =33		**Tutorials =0**	**Practical =07**			

8. Brief Syllabus

Advanced soil mechanics includes the study of stress and strain in soil, shear strength concept in soil, pour water pressure, consolidation and critical state of soil mechanics.

9. Learning objectives:

This course intends to bridge the basic soil mechanics concepts with the advanced topics related to stresses and soil strength. In the process, it will help to reinforce the understanding gained during the undergraduate learning and would help to alleviate any misconceptions related to the stress-strain response and strength behaviour of soils.

10. Course Outcomes (COs):

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

1. Stress -stain behaviour in soil
2. Understand the concept Shear strength analysis in various soil
3-Analysis the pore water parameters and distribution of pore pressure
4-Understand and analysis the critical condition of soil

11. Unit wise detailed content

1- Analysis of Cauchy stress
2- Mathematical formulation of plane stress plane strain.
3- Laboratory study of measurement of shear strength of soil
4- Estimation of pore water pressure
5- Study about primary and secondary consolidation process
6- Modified Cam clay model
7- Field visits to understand the physical properties of various soils

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Advanced Structural Analysis**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Strength of Materials, Engg. Mechanics	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. **Brief Syllabus:** Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures

8. Learning objectives:

1. To understand the methods of analysis.
2. To know the different techniques available for the analysis of structures.
3. To identify the best suitable method of analysis.

9. Subject Outcomes: On completion of this course, the students will be able to

1. Identify the method of analysis for determinate structures
2. Understand the importance of various methods of slop and deflections for determinate structures.
3. Use the influence line diagram.
4. Understand the methods of analysis for multi-storeyed frames

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Method of Consistent deformations**

Analysis of beams frames and trusses with internal and external redundancy(Simple problems with maximum two redundant) Concepts of effect of prestrain, lack of fit, temperature changes and support settlement.(No numerical problems)

Unit - 2	**Number of lectures = 10**	**Title of the unit: Cables**

Analysis of forces in cables under concentrated and uniformly distributed loads - Anchor Cables

Unit - 3	**Number of lectures = 10**	**Title of the unit: Influence Lines for Indeterminate Structures**

Muller-Breslau's Principle, Steps for obtaining I.L for Reactions and Internal Forces in Propped Cantilever Beam and Continuous Beam, Qualitative I.L.D for Rigid Jointed Structures Having Higher

Statically Indeterminacy		
Unit - 4	**Number of lectures = 12**	**Title of the unit: Matrix Methods**
Types of skeletal structures, Internal forces and deformations. Introduction and applications of stiffness method to analyze beams, Trusses and plane frames by system approach.		

11. Books Recommended

Text Books

1. R.C. Hibbler , Structural Analysis (2011) , Pearson Education

Reference Books

1. Jain,O.P.and Jain, B.K., "Theory &Analysisof Structures ". Vol.I& II Nem Chand brothers.
2. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill
3. Chukia Wang
4.Coates,R.C.,Coutie,M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson.

<table>
<tr><td colspan="2">1. Name of the Department</td><td colspan="6">CIVIL ENGINEERING</td></tr>
<tr><td>2. Subject Name</td><td>Advanced Structural Analysis Lab</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>3. Subject Code</td><td></td><td>0</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="2">4. Type of Subject</td><td>Core ()</td><td colspan="2">PE(√)</td><td colspan="2">OE()</td></tr>
<tr><td>5. Pre-requisite (if any)</td><td>Structural Analysis</td><td>Frequency (use tick marks)</td><td>Even ()</td><td>Odd (√)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 00</td><td colspan="2">Tutorials = 00</td><td colspan="2">Practical = 28</td></tr>
<tr><td colspan="8">7. Brief Syllabus:
Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. In the Lab students will apply load on different apparatus and will understand the behavior of different structural member.</td></tr>
<tr><td colspan="8">8. Learning objectives:
1. To understand the methods of analysis.
2. To know the different techniques available for the analysis of structures after application of load.
3. To identify the best suitable method of analysis for different structural member.</td></tr>
<tr><td colspan="8">9. Course Outcomes (COs):
On completion of this course, the students will be able to
1. Identify the method of analysis for determinate structures
2. Understand the importance of various methods of slop and deflections for determinate structures.
3. Use the influence line diagram.</td></tr>
<tr><td colspan="8">10. Unit wise lab detailed content</td></tr>
<tr><td colspan="8">1. Analysis of beams frames
2. Analysis of trusses
3. Check of internal and external redundancy
4. Analysis of forces in cables
5. Obtaining I.L for Reactions and Internal Forces in Propped Cantilever Beam
6. Obtaining I.L for Reactions and Internal Forces in Continuous Beam
7. Qualitative I.L.D for Rigid Jointed Structures</td></tr>
</table>

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Project planning and management**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem (√)	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

Construction project planning and administration the art of directing and coordinating human an material resources throughout the life of a project by using modern management techniques to achiev predetermined objectives of scope, cost, time, quality and participation satisfaction. Teaching thes requirements by the designed course content.

8. Learning objectives:

1. To train the students in the field work so as to have a firsthand knowledge of practical problem related to Construction Management in carrying out engineering tasks
2. To optimize the time of construction of a project by project planning tools.
3. To update the planners at site for material resources, time scheduling and project cost.
4. To give knowledge of risk management and remedial measures.
5. To make students aware of different construction equipment.

9. Subject Outcomes:

On completion of this course the students will be able

1. To plan, schedule and control the construction of the project.
2. To use project planning tools.
3. To carry out cost analysis and project updating.
4. To study risk analysis and resource allocation at site.
5. Understand different types of construction equipment its uses and output.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Project Management**

Introduction, Project planning, scheduling, controlling, Role of decision in project management, Project management Process and role of Project Manager.

Bar Charts and Milestones Chart: Introduction, Development of bar chart, Shortcomings and remedi measures, Milestone charts.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Project Planning Tools**

CPM & PERT: Elements of network, Time estimates, frequency distribution, mean, variance an standard deviation, probability distribution.

Network Analysis: Slack, Float, Critical path, crashing of activity.

Introduction, Projects cost: Direct cost, Indirect cost, slope of direct cost curve, total project cost an optimum duration, cost optimization.

Unit - 3	Number of lectures = 10	Title of the unit : Cost Analysis& Updating

Project Updating: Introduction, updating process, data required for updating, steps in process updating

Construction Equipment

Types of compaction Equipment's, Types of Excavation and digging Equipment's, Types of hoistin equipment's, Types of Material handling Equipment's and Types of heavy earth moving equipment's.

Unit - 4	Number of lectures = 12	Title of the unit: Risk analysis and Resourc allocation

Certainty, risk and uncertainty, risk management, identification and nature of construction risk contractual allocation of risk, types of risks, minimizing risks and mitigating losses, use of expecte values, utility in investment decisions, decision trees, sensitivity analysis.

Resource Allocation: Resource usage profiles, Resource smoothing and levelling.

11. Books Recommended

Text Books

1. Project Planning and Control with PERT and CPM by B. C. Punmia, K.K. Khandelwal, Laxmi Publication.

References

1. Peurifoy,R.L., Ledbetter.W.B and schexnayder,C, construction planning and equipment methods, McGraw Hill, Singapore.

2.Callahan,M.T., Quackenbush,D.G.,and rowing,J.E., Construction project scheduling, McGraw Hi ,New York.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Project planning and management Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		Core ()	PE ()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Learning objectives:

1. To train the students in the field work so as to have a firsthand knowledge of practical problem related to Construction Management in carrying out engineering tasks
2. To optimize the time of construction of a project by project planning tools.
3. To update the planners at site for material resources, time scheduling and project cost.

8. Course Outcomes (COs):

At the end of the lab course student able to

9. Subject Outcomes:

On completion of this course the students will be able

1. To plan, schedule and control the construction of the project.
2. To use project planning tools.
3. To carry out cost analysis and project updating.

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Project organization - selecting an appropriate project organization
2	Project planning - establishing the Work Breakdown Structure and mapping this structure
3	The Critical Path Method (CPM)
4	The Program Evaluation and Review Technique (PERT)
5	Critical Chain Planning
6	Project Monitoring - configuration and metrics used to monitor the progress of a project

1. Name of the Department		**CIVIL ENGINEERING**					
2. Course Name	Analytical and Digital Photogrammetry	**L**	**T**		**P**		
3. Course Code		3	0		0		
4. Type of Course		✓ **Core ()**	**PE()**		**OE()**		
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	✓ Odd ()	Either Sem ()	Every Sem ()	
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)							
Lectures = 42		**Tutorials = 00**	**Practical = 00**				

Brief Syllabus Procedures and methods used for deriving metric information from photographs, analog processes for using aerial photographs in production of topographic maps, flight planning, and cost estimation in aerial mapping work. Introduction to photo coordinate measurement devices and their calibration. Mathematics of modern Photogrammetry.

8. Learning objectives:

With the advent of computing and imaging technology, Photogrammetry has evolved from analogue to analytical to digital Photogrammetry. The main difference between digital Photogrammetry and its predecessors (analogue and analytical) is that it deals with digital imagery directly rather than (analogue) photographs.

9. Course Outcomes:

The student will be able to:

1) Understand basic photogrammetric & remote sensing techniques
2) Perform basic photogrammetric office computations Apply Photogrammetry information to professional surveying services
3) Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of Photogrammetry
4) Apply current knowledge and adapt to emerging applications of Photogrammetry and technology.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit** : Fundamentals of Aerial Photography Systems

Historical development – classification, application – aerial cameras – aerial films and processing, – geometry of vertical photographs – scale – coordinate transformation, relief displacement – titled photographs

Unit-2	**Number of lectures = 10**	**Title of the unit:** Stereoscopy

Stereoscopes, stereoscopic view and its exaggeration – parallax equation – parallax measurement– parallax bar-measurement of heights and determination of slopes stereoscopic plotting instruments

Unit - 3	**Number of lectures = 12**	**Title of the unit:** Orientation, Photomaps and Mosaic

Concepts of orientation-interior, relative and absolute orientation of aerial photographs, Ground control, Advantages and disadvantages, Uses, Kinds of mosaics-controlled, semi-controlled, uncontrolled, Preparation, orthophotosmosaics

Unit - 4	**Number of lectures =10**	**Title of the unit:** Project Planning and Aerial Photo Interpretation

Flight planning –ground control (horizontal and vertical) for aerial Photogrammetry - image interpretation - interpretation keys – planimetric mapping applications – aerial mosaics..

11. Brief Description of self learning / E-learning component

1. https://swayam.gov.in/course/3697-Analytical and Digital Photogrammetry

12. Books Recommended

TEXTBOOKS :

- Lillesand T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.
- Wolf P. R., Elements of Photogrammetry with Application in GIS, McGraw Hill International Book Company,2013.
- Moffitt, Francis H. & Mikhail, Edward M., Photogrammetry, Harper and Row Publishers, 1980.
- Hallert, B., Photogrammetry, McGraw Hill Book Company, 1960

1. Name of the Department		**CIVIL ENGINEERING**					
2. Course Name	Analytical and Digital Photogrammetry Lab	**L**		**T**		**P**	
3. Course Code		0		0		2	
4. Type of Course		✓ **Core ()**		**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**		Even ()	✓ Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)							
Lectures =		**Tutorials = 00**		**Practical = 28**			

Brief Syllabus: Procedures and methods used for deriving metric information from photographs, analog processes for using aerial photographs in production of topographic maps, flight planning, and cost estimation in aerial mapping work. Introduction to photo coordinate measurement devices and their calibration. Mathematics of modern Photogrammetry.

8. Learning objectives:

1) The concepts of a datum, a projection, and a geoids model.
2) Will be able to select an appropriate projection and couple it with a geoids model to present data collected using GPS in a Cartesian coordinate system.

9. Course Outcomes:

On completion of the class the student will understand

1) The concepts of a datum, a projection, and a geoids model.
2) Will be able to select an appropriate projection and couple it with a geoids model to present data collected using GPS in a Cartesian coordinate system.

10. Unit wise detailed content

1) classification, application – aerial cameras
2) Study of geometry of vertical photographs
3) Stereoscopes, stereoscopic view and its exaggera
4) Measurement of heights and determination of slopes
5) Relative and absolute orientation of aerial photograph
6) Concepts of orientation-interior, relative and absolute orientation of aerial photographs
7) flight planning –ground control (horizontal and vertical) for aerial Photogrammetry

1. Name of the Department: Civil Engineering						
2. Course Name	Earth and Environment	**L**	**T**		**P**	
3. Course Code		3	0		4	
4. Type of Course (use tick mark)		**Core ()**	**PE(✔)**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

8. Brief Syllabus

The course brief about the natural environment encompasses all living and non-living things occurring naturally, meaning in this case not artificial. The term is most often applied to the Earth or some parts of Earth. This environment encompasses the interaction of all living species, climate, weather and natural resources that affect human survival and economic activity. This will enhance student understanding about the environmental conditions as well as resources available to us. Moreover, learner will be introduced with energy sources and alternative ways to sustain energy supply.

9. Learning objectives:

1. To expose the student to current environmental conditions of the earth.
2. To teach about the basics of earth resources and how to use them in a sustainable way.
3. To aware students about environmental concerns at global level.
4. To decipher world food supply systems and how to sustain that in current challenges.
5. To aware about the energy demands at global level and its alternatives.

10. Course Outcomes (COs):

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

2. Apply the basic concepts of Environment in developing system for sustainable energy.
2. Manage the earth resources in a judicious way to maintain the goal of energy conservation.
3. To work out alternative energy sources for better future.
4. To maintain the continuous supply of food requirement through innovative techniques.
5. To work on global level platform to protect the environment at large.

11. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Definitions and Concepts**

Introduction to Earth and Earth systems Processes governing environmental conditions; Composition of Biosphere, Atmosphere, and Factors leading to climate change, Introduction to Geologic, Tectonic, and biogeochemical cycles.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Earth Resources**

Earth resources, Significance of natural resources, Renewable biological resources, wildlife conservation/management, fisheries, forestry, mineral resources, mineral availability and recycling, environmental impacts of use of resources, air, water and soil resources. Scarcity and conservation strategies.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Earth's Energy Budget**
Energy resources, Energy consumption, Energy use and efficiency, current energy sources, energy issues, climate change and energy, and future renewable energy alternatives.		
Unit - 4	**Number of lectures = 8**	**Title of the unit: World Food Supply & Major Environmental Concerns**
World food supply; traditional agriculture, green revolution, aquaculture, modern agriculture, ecological impacts of modern agriculture, organic farming. Natural hazards, Dams and environment, Global climate and hazards, effect of population increase on environment, Historical perspective of Growing environmental concerns. Exposure to applications based on current industrial trends.		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Reshaping Environments - An Interdisciplinary Approach to Sustainability in a Complex World Helena Bender (2012).
2. Earth-Evolution of a Habitable World (2013) Jonathan I. Lunine.
3. Environmental Change- Key Issues and Alternative Perspectives (2005) Frank Oldfield.
4. Environmental Engineering, by Peavy, McGraw Hill, January 2013.
5. Environmental Engineering, by Gerard Kiely, McGraw Hill Education (15 July 2006)

1. Name of the Department: Civil Engineering						
2. Course Name	Earth and Environment Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward Earth system. In addition to that, this course will inculcate the understanding about parameters involved in the determination of environment.

8. Learning objectives:

1. Understand the processes for determination of environment variables.
2. To gain insight into basic concept of earth systems.
3. Understand the parameter involved in determination of environment variables.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of atmospheric variables.
2. Apply the understanding of analytical techniques toward parameters that atmospheric processes.

8. Unit wise detailed content

1. To measure of atmospheric pressure in a region.
2. To analysis of the atmospheric temperature conditions
3. To determine the vapour pressure in a region.
4. To relative humidity and dew point temperature
5. To estimate the heat indices.
6. Determination of Solids in Water
7. Determination of Turbidity of Water
8. Determination of Alkalinity of Water
9. Determination of Hardness of Water by EDTA Titrimetric Method
10. Determination of pH of water

Departmental Electives -VI

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Environmental Impact Assessment and Management**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures =42		**Tutorials = 00**	**Practical = 00**			

7. Learning objectives:

1. Identify the need to assess and evaluate the impact on environment.
2. Major principles of environmental impact assessment
3. Understand the different steps within environmental impact assessment

8. Subject Outcomes: On completion of this course, the students will be able to

1) Overview of assessing risks posing threats to the environment
2) Be able to access different case studies/examples of EIA in practice
3) Able to liaise with and the importance of stakeholders in the EIA process.

9. Unit wise detailed content

Unit-1	**Number of lectures = 09**	

Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Unit – 2	**Number of lectures = 08**	

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Unit – 3	**Number of lectures = 08**	

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

Unit – 4	**Number of lectures = 08**	

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Environmental Impact Assessment and Management laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials =0**	**Practical =28**			

7. Learning objectives:

1. Identify the need to assess and evaluate the impact on environment.
2. Major principles of environmental impact assessment
3. Understand the different steps within environmental impact assessment

8. Subject Outcomes: On completion of this course, the students will be able to

1) Overview of assessing risks posing threats to the environment
2) Be able to access different case studies/examples of EIA in practice
3) Able to to liaise with and the importance of stakeholders in the EIA process

9. Unit wise detailed content

1. Study the initial environment examination before implementation of EIA.
2. Explore the method of matrix and ad-hoc for the purpose of eia methodology selection.
3. Calculate the cost requirements for the purpose of benefits analysis.
4. Explore nearby wildlife and vegetation that are in verge of extinction.
5. Conduct a social awareness for stopping deforestation and enhance the plantation drive.
6. Study nearby water resources for the purpose of Pollution control.

1. Name of the Department		**CIVIL ENGINEERING**				
2.Subject Name	**Geotechnology**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Soil Mechanics	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Learning objectives:

1. To understand the design aspects of foundation.
2. To evaluate the stress developed in the soil medium.
3. To understand the framework of soil investigation.

8. Subject Outcomes: Comprehend and utilize the geotechnical literature to establish the framework for foundation design.

1. Plan and implement a site investigation program including subsurface exploration to evaluate soil/structure behavior and to obtain the necessary design parameters.
2. Carry out slope stability analysis for various fills and slopes.
3. Determine allowable bearing pressures and load carrying capabilities of different foundation systems.

9. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Failure Envelope and Earth Pressure**

Mohr's-Columb, Tresca and Von Mises theories. Earth Pressure- Active and Passive state of earth pressure and pressure at rest. Rankines and Columb wedge theory. Earth pressure computation for practical cases.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Slope Stability**

Failure of finite and infinite slopes – Swedish circle method, Friction Circle method, Taylors stability number and stability curves, Factor of safety, slope stability of earth dams, introduction to Bishop's method.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Shallow Foundation and Deep Foundation**

Bearing capacity- Minimum depth of foundation, Failure theories, Meyerhof's analysis, different equations for bearing capacity, effect of water table on bearing capacity. IS code method for computing bearing capacity.

Shallow Foundations: Safe bearing capacity, Settlement of footings - immediate and time dependent settlement, permissible limits, differential settlement.

Deep Foundations: Classification and selection of piles, static and dynamic formulae for single pile capacity, efficiency and capacity of pile groups, settlement of pile groups, load test on piles as per BIS codes. Classification and selection of under reamed pile.

Unit – 4	**Number of**	**Title of the unit: Site Investigation and Soil Exploration**

	lectures = 12	

Objective of site investigation, reconnaissance, detailed site investigation, methods of exploration, geophysical methods, seismic refraction survey. Depth of exploration, selection of foundation, plate load test, standard penetration test.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Dr. K.R. Arora , Soil Mechanics and Foundation Engineering(2011), ISBN No. 81-8014-112-8, Seventh Edition, Standard Publishers Distributors, Delhi .

Reference Books

1. Shashi K. Gulhati&Manoj Datta, Geotechnical Engineering, Tata McGraw Hill Ltd.
2. Donald P Coduto, William A. Kitch, Man-chu Ronald Yeung, Geotechnical Engineering: Principles and Practice, Pearson Education.
3. Joseph E. Bowles, Foundation Analysis and Design, McGraw-Hill, New York.
4. Arun Kr. Jain, & B.C. Punmia, Ashok Kr. Jain, Soil Mechanics and Foundations, Laxmi Publications.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Geotechnology Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Soil Mechanics	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 00		**Tutorials = 00**	**Practical =28**			

7. Learning objectives:

1. To understand the design aspects of foundation.
2. To evaluate the stress developed in the soil medium.
3. To understand the framework of soil investigation.

8. Subject Outcomes:

1. Comprehend and utilize the geotechnical literature to establish the framework for foundation design.
2. Plan and implement a site investigation program including subsurface exploration to evaluate soil/structure behavior and to obtain the necessary design parameters.
3. Carry out slope stability analysis for various fills and slopes.
4. Determine allowable bearing pressures and load carrying capabilities of different foundation systems.

9. Unit wise detailed content

Sr. No.	**Title**	**CO covered**
1	Standard Procter Test	1,2
2	Consolidation Test	3
3	Hydrometer Test	1,3
4	Plate Load Test	2
5	Tri-axial test	3
6	Direct Shear Test	3
7	Unconfined Compression Test	2
8	CBR Test	1,2

Departmental Electives- VII

1. **Name of the Department**		CIVIL ENGINEERING					
2. **Course Name**	Energy Efficient Structures	L	T		P		
3. **Course Code**		3	0		0		
4. **Type of Course**		Core ()	PE(√)		OE()		
5. **Pre-requisite (if any)**	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()	
6. **Total Number of Lectures, Tutorials, Practical**							
Lectures = 42		Tutorials =00	Practical = 00				

7. **Brief Syllabus:**

Green Buildings, Energy and Environment, Renewable Energy, Site and Climate, Building Form and Fabric, Energy Awareness, Infiltration, Ventilation, Lighting, Cooling and Water Conservation .

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8. **Learning objectives:**

1.This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century.

2. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings

3. To give a full understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation.

4. To highlight the importance of Environmental Management as well as Environmental impact Assessment methods in Energy efficient buildings.

10.Course Outcomes: On completion of this course, the students will be able to

1. Understand to make buildings energy efficient.

2. Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaic, and Ground source heat pumps, and their adaption to green Building concepts.

3. Understand the concepts of Site and Climate, Building Form, Building Fabric, Infiltration and ventilation, Lighting, Heating, Cooling, Energy Management and water conservation.

4. Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge Management strategies too.

11.Unit wise detailed content

Unit-1	**Number of lectures = 010**	**Title of the unit: Green Buildings, Energy and Environment & Energy awareness**

Green Buildings within the Indian Context - Types of Energy - Energy Efficiency and Pollution - Better Buildings - Reducing energy consumption - Low energy design. Energy awareness - monitoring energy consumption - Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED) Sustainable architecture and urban design -

principles of environmental architecture - Benefits of green buildings - Energy Conservation Building code – NBC.

Unit - 2	Number of lectures = 10	Title of the unit: Renewable Energy, Site and Climate

Renewable Energy sources that can be used in Green Buildings - Solar energy - Passive Solar Heating - Passive Solar collection - Wind and other renewable - A passive solar strategy - Photovoltaics - Climate and Energy - Macro and Microclimate - Indian Examples.

Unit - 3	Number of lectures = 10	Title of the unit: Building Form and Fabric

Building Form - Surface area and Fabric Heat Loss - utilizing natural energy - Internal Planning - Grouping of buildings - Building Fabrics - Windows and doors - Floors - Walls - Masonry - Ecological walling systems - Thermal Properties of Construction Material.

Unit - 4	Number of lectures = 12	Title of the unit: Infiltration, Ventilation, Lighting, Cooling and Water Conservation

Infiltration and ventilation - Natural ventilation in commercial buildings - passive cooling - modelling air flow and ventilation - Concepts of daylight factors and day lighting - daylight assessment - artificial lighting - New light sources - Cooling buildings - passive cooling - mechanical cooling - Water conservation- taps, toilets and urinals, novel systems - collection and utilization of rain water.

13.Books Recommended

1. William T. Meyer, (2007), Energy Economics and Building Design, McGraw - Hill, ISBN: 9780070417519.

REFERENCE BOOKS

1. Sim Van Der Ryn and Stuart Cowan, “Ecological Design”, Annotated Edition, Island Press ISBN-13: 9781597261418.
2. Richard D. Rush, (1991), The Building System Integration Handbook., Butterworth – Heinemann Ltd, ISBN-13: 9780750691987.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Energy Efficient Structure Lab	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	BCM Lab	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Brief Syllabus:

Green Buildings, Energy and Environment, Renewable Energy, Site and Climate, Building Form and Fabric, Energy Awareness, Infiltration, Ventilation, Lighting, Cooling and Water Conservation.

8. Learning objectives:

1.This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century.

2. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings

3.To give a full understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation.

4. To highlight the importance of Environmental Management as well as Environmental impact Assessment methods in Energy efficient buildings.

9. Course Outcomes (COs):

On completion of this course, the students will be able to

1. Understand to make buildings energy efficient.

2. Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaic, and Ground source heat pumps, and their adaption to green Building concepts.

3. Understand the concepts of Site and Climate, Building Form, Building Fabric, Infiltration And ventilation, Lighting, Heating, Cooling, Energy Management and water conservation.

4. Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge Management strategies too.

10. Unit wise lab detailed content

1. Reducing energy consumption - Low energy design.

2. Building Environmental Assessment.

3. Sustainable architecture and urban design.

4. Use of Solar energy in Green Buildings.

5. Use of Wind energy and other renewable resource in Green Buildings.

6. Building Form - Surface area and Fabric Heat Loss study.

7. Study of Passive cooling & modelling air flow and ventilation.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Quantitative Methods in Construction Management**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	**Frequency (use tick marks)**	Even ()	Odd (√)	**Frequency (use tick marks)**	Even ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

This Course will introduce theoretical and practical aspects of construction management techniques to achieve project goals. & possess organizational and leadership capabilities for effective management of construction projects

8. Learning objectives:

1. To review the basics of Optimization principles
2. To study the optimization techniques and simulation of models
3. To apply the concepts studied to inventory, scheduling and other related problems

9. Subject Outcomes:

On completion of this course the students will be able to know operations research, production management, and financial management and cost concepts.

10. Unit wise detailed content

Unit-1	**Number of lectures = 09**	**Title of the unit: Introduction To Operations Research**

Introduction to Operations research-Linear programming-Graphical and Simplex Methods-Duality and Post-Optimality Analysis- Dynamic programming- Capital Budgeting problem, Reliability improvement problem, Shortest path method

Unit - 2	**Number of lectures = 08**	**Title of the unit: Optimization Techniques**

Integer Programming- Branch and bound techniques-Transportation Problems -Least cost method, North west corner cell method, Vogel's approximation method, U-V method- Work Assignment Problems.

Unit - 3	**Number of lectures = 08**	**Title of the unit: Inventory Management**

Application to Production Scheduling-Single machine scheduling, Flow Shop Scheduling, Job shop Scheduling -Inventory control, Economic order quantity (EOQ), Quantity Discounts, Safety Stock.

Unit - 4	**Number of lectures = 08**	**Title of the unit: Optimization Theory and Cost Concepts**

Replacement Theory - Decision Theory-Decision Rules-Decision making under conditions of certainty, risk and uncertainty - Decision trees-Utility Theory- Bayes theory

Cost concepts-Break-even -Analysis-Pricing techniques- Simulation Models Game Theory applications

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. Vohra, N.D. “Quantitative Techniques in Management ", Tata McGraw Hill Co., Ltd, New Delhi, 2000.

Referance books

1. Frank Harrison, E., “The Managerial Decision Making Process ", Houghton MiffinCo.Boston
2. Varshney, R.L. and Maheswari, K.L., “Managerial Economics ", Sultan Chand, 2005.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Quantitative Techniques in Construction Management Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-XV()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 00	**Tutorials = 00**	**Practical = 28**

7. Learning objectives:

1. To train the students in the field work so as to have a firsthand knowledge of practical problem related to Construction Management in carrying out engineering tasks
2. To optimize the time of construction of a project by project planning tools.
3. To update the planners at site for material resources, time scheduling and project cost.

8. Course Outcomes (COs):

At the end of the lab course student able to

9. Subject Outcomes:

On completion of this course the students will be able

1. To plan, schedule and control the construction of the project.
2. To use project planning tools.
3. To carry out cost analysis and project updating.

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Reliability improvement problem
2	Transportation Problems
3	Application to Production Scheduling-Single machine scheduling
4	Replacement Theory
5	Decision trees-Utility Theory- Bayes theory
6	Simulation Models Game Theory applications

1. Name of the Department		**CIVIL ENGINEERING**					
2. Course Name	Advanced Digital Image Processing	**L**	**T**		**P**		
3. Course Code		3	0		0		
4. Type of Course		✓ **Core ()**	**PE()**		**OE()**		
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	✓ Odd ()	Either Sem ()	Every Sem ()	
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)							
Lectures = 42		**Tutorials = 00**	**Practical = 00**				

Brief Syllabus Procedures and methods used for deriving metric information from photographs, analog processes for using aerial photographs in production of topographic maps, flight planning, and cost estimation in aerial mapping work. Introduction to photo coordinate measurement devices and their calibration. Mathematics of modern Photogrammetry.

8. Learning objectives:

With the advent of computing and imaging technology, Photogrammetry has evolved from analogue to analytical to digital Photogrammetry. The main difference between digital Photogrammetry and its predecessors (analogue and analytical) is that it deals with digital imagery directly rather than (analogue) photographs.

9. Course Outcomes:

The student will be able to:

1) Understand basic photogrammetric & remote sensing techniques
2) Perform basic photogrammetric office computations Apply Photogrammetry information to professional surveying services
3) Demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of Photogrammetry
4) Apply current knowledge and adapt to emerging applications of Photogrammetry and technology.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit** : Introduction

Image acquisition and format - Satellite data acquisition, DN characters-kernels- storage devices, CC, CDisk, Optical disk. Data retrieval. Export and import, Data formats, BSQ, BIL, BIP, Run length encoding, Image Compression Data products , hard copy, digital products, Image display system, requirement.

Unit-2	**Number of lectures = 10**	**Title of the unit:** Image distortion and rectification

Image distortion and rectification - Introduction-Sensor model, Preprocessing and Post processing Geometric distortion, sources and causes for distortion, rectification, GCP, Resampling, Image registration, transformation, Radiometric distortion, sources and causes, Computation of radiance, Computation of reflectance, cosmetic operations, Noise removal, atmospheric correction.

Unit - 3	Number of lectures = 12	**Title of the unit:** Image enhancement

Image enhancement - Satellite image statistics, Univariate and multi-variants statistics. Basics of Histogram, noise models, image quality. Contrast manipulation, grey level thresholding, level slicing, contrast stretching- Spatial feature manipulations, spatial filtering, convolution Low pass, high pass, edge enhancement, edge detection, Fourier analysis.

Unit - 4	Number of lectures =10	**Title of the unit:** Image classification

Image classification - Introduction, Classification techniques, feature extraction, Supervised, training stage, classification stage, scatterogram, minimum distance to mean classifier, Parallelepiped classifier, Gaussian maximum Likelihood classifier, unsupervised classification, Hybrid classifier, classification of mixed pixel-fuzzy classification, output stage, classification accuracy , error matrix.

11. Brief Description of self learning / E-learning component

1. https://swayam.gov.in/course/3697-Analytical and Digital Photogrammetry

12. Books Recommended

TEXTBOOKS :

- M. Anji Reddy, Textbook of Remote Sensing and Geographical Information systems, BS Publications, Hyderabad. 2011. ISBN : 81-7800-112-8
- Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman Remote sensing and image interpretation John Wiley & Sons, 2008

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Advanced Digital Image Processing Lab	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		✓ **Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	✓ Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures =		**Tutorials = 00**	**Practical = 28**			

Brief Syllabus: Digital image processing is the use of a digital computer to process digital images through an algorithm. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing.

8. Learning objectives:

To study the image fundamentals and mathematical transforms necessary for image processing.

- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures

9. Course Outcomes:

At the end of the course the student will be able to understand

- Review the fundamental concepts of a digital image processing system.
- Analyze images in the frequency domain using various transforms.
- Evaluate the techniques for image enhancement and image restoration.
- Categorize various compression techniques.
- Interpret Image compression standards.
- Interpret image segmentation and representation techniques

10. Unit wise detailed content

1. Study of Familiarization with digital image processing & image processing software
2. Study of Importing raw data, Displaying image data
3. Study of Image Rectification & Registration, Image Enhancement & Transformation
4. Study of Unsupervised Classification, Training site marking & Supervised Classification
5. Study of Accuracy Assessment, Map Composition
6. Study of Image Data Fusion. Calculation of area and Accuracy Assessment

1. Name of the Department: Civil Engineering						
2. Subject Name	Environmental Remote Sensing	**L**	**T**		**P**	
3. Subject Code		3	0		4	
4. Type of Subject (use tick mark)		**Core ()**	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

Environmental Remote Sensing is designed to introduce students to remote sensing science and technology. It emphasizes mastering fundamental remote sensing concepts and utilizing remotely sensed data for environmental information extraction and problem solving. Students will develop a basic understanding and working knowledge of the principles and applications of remote sensing including satellite multispectral data sets, matter-energy interactions, radiation transfer theory, image interpretation, computer-assisted analysis, and remote sensing applications. It will also provide a survey of the concepts and techniques of remote sensing and image analysis for mapping and monitoring natural resources, environment and land use and a wide spectrum of geoscientific applications ranging from meso- to global scale. It will also cover how remote sensing is used as a tool of geo-exploration.

8. Learning objectives:

1. Understand the fundamental concepts and principles of remote sensing
2. Understand the advantages and limitations of remote sensing
3. Understand the methods and techniques of remote sensing
4. Apply remote sensing techniques to resource inventory, monitoring and analysis
5. Apply remote sensing techniques to geological analysis, ranging from laboratory spectra of minerals and rocks, ground truth, to aerial and space-borne remote sensing.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Apply remote sensing techniques to resource inventory, monitoring and analysis.
2. Apply remote sensing techniques to geological analysis, ranging from laboratory spectra of minerals and rocks, ground truth, to aerial and space-borne remote sensing.
3. Able to understand the potential of contemporary image processing and analysis systems.
4. Able to choose remote sensing data and analysis approaches based on the problems to be solved.
5. Able to understand the prospects for future sensing systems and applications.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Physics of Remote Sensing & Microwave Remote Sensing**

Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features.

Microwave Remote Sensing: Active and Passive Systems, Advantages, Platforms and Sensors, Applications: Geosciences, Water Resources, Land use-Land cover, Transportation Engineering.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Data Acquisition Platforms**
Various types of platforms, different types of aircraft, manned and unmanned space crafts used for data acquisition - characteristics of different types of platforms -LANDSAT, SPOT, IRS, ERS, INSAT and other platforms.		
Unit - 3	**Number of lectures = 12**	**Title of the unit: Data Acquisition Sensors (Visible & Infrared)**
Photographic products, Resolving power of lenses and films, Optomechanical / Electro optical sensors - spatial, spectral and radiometric resolution, Thermal sensors, Geometric Characteristics of thermal imagery, calibration of thermal scanner, signal to noise ratio.		
Unit - 4	**Number of lectures = 8**	**Title of the unit: Data Analysis**
Data Products and Their Characteristics, Data Pre-processing – Atmospheric, Radiometric, Geometric Corrections - Basic Principles of Visual Interpretation, Equipment for Visual Interpretation, Ground Truth, Ground Truth Equipment. Exposure to applications based on current industrial trends.		

11. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Campbell, J.B. 2007. Introduction to Remote Sensing, 4th Edition, The Guilford Press.

2. Lillesand, T.M., Kiefer, R.W. & Chipman, J.W. 2008. Remote Sensing and Image Interpretation, 6th Edition, John Wiley and Sons.

3. Barrett, E.C. & Curtis, L.F. 2007. Introduction to Environmental Remote Sensing, Routledge Publisher.

4. Gupta, R.P. 2003. Remote Sensing Geology, 2nd Edition, Springer.

5. Journals, International Journal of Remote Sensing & Remote Sensing of Environment.

1. Name of the Department: Civil Engineering						
2. Course Name	Environmental Remote Sensing Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward Environmental Remote Sensing methods. In addition to that, this course will inculcate the understanding about parameters involved in Environmental Remote Sensing analysis.

8. Learning objectives:

1. Understand the processes for determination of Environmental Remote Sensing parameters.
2. To gain insight into basic concept Environmental Remote Sensing.
3. Understand the parameters involved in determination of Environmental Remote Sensing Processes.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of Environmental Remote Sensing and Processes.

2. Apply the understanding of analytical techniques toward parameters that influences Environmental Remote Sensing.

8. Unit-wise detailed content (Explanatory Experimentation)

1. Remote Sensing for Object-based image analysis.
2. Remote Sensing for inland water quality.
3. Remote Sensing for Image texture analysis
4. Remote Sensing for Dynamic segmentation model for linear geographical features
5. Remote Sensing for Contour tree & Reeb graphs
6. Remote Sensing for Spatial clustering.
7. Remote Sensing for Hydrological simulation and modeling.
8. Remote Sensing for Coral reefs and benthic habitats.
9. Remote Sensing for Snow melting, glacial dynamics, and mass balance
10. Remote Sensing for High Altitude Region.

Sixth Semester

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Design of Steel Structures-I**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Structural Analysis	**Frequency (use tick marks)**	Even(√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures 33		**Tutorials =00**	**Practical = 00**			

7. **Brief Syllabus:** Study of BIS Codes *i.e.* IS: 800-1984, IS: 800-2007 related to design of steel structures. Study of design of different types of connections, simple and built up beams, laterally supported and unsupported beams. The subject imparts knowledge of design beams and columns under combined stresses. Design simple and built up beams and columns.

8. Learning objectives:

1. To teach students loading and load combinations for the design of steel structures.
2. To make the students familiar with the concepts of steel design starting with riveted, welded and bolted connections and eccentric connections based on IS:800-1984 and IS:800-2007.
3. To teach the students design of tension, compression members and flexural members based on IS: 800-2007.
4. To teach students beam-column design as a whole for uniaxial and biaxial loading along with elastic theory of buckling of beams and columns.

9. Subject Outcomes: On completion of this course, the student will be able to

1. Calculate load required on structure for the design of steel structure members.
2. Design different type of joints and connections.
3. Design of tension, compression and flexural members of the steel structures.
4. Design beam-columns as a whole for different steel structural frame.

10. Unit wise detailed content

Unit-1	**Number of lectures = 9**	**Title of the unit: Introduction**

Properties of structural steel, Rolled steel sections as per IS specifications, factor of safety.
Limit state design of Connections: welded and bolted connections, design of fillet and butt weld, eccentric connections, efficiency of joints, high tension bolts.

Unit - 2	**Number of lectures = 8**	**Title of the unit: Tension Member & Compression Member based on IS:800-2007**

Net Sectional Area, Permissible Stress, Design of Axially Loaded Tension Member, Design of Member Subjected to Axial Tension and Bending.
Column: Modes of Failure of a Column, Buckling Failure: Euler's Theory, Effective Length, Slenderness Ratio. Design of Compression Members, Design of Built-Up Compression Members: Laced and Battened Columns, Design of column splice.

Unit - 3	**Number of lectures = 8**	**Title of the unit: Design of Beams, Column Bases and Grillage**

		foundation
Introduction, beam type, section classification, lateral stability of beam, lateral torsional buckling of symmetrical section, design strength of beam (Laterally supported and unsupported), shear strength and deflection, web buckling and web crippling. Design of slab base and gusset base and grillage foundation along with its connection with column.		
Unit - 4	**Number of lectures = 08**	**Title of the unit: Design of Gantry Girder**
Gantry Girder: Introduction, loading consideration, maximum load effect, selection of gantry girder, design of gantry girder		

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

1 **Text Books**

1. Design of Steel Structures by N. Subramanian (2012),ISBN No. 978-0-19-567681-5, 8th edition Oxford Publication.

Reference Books

1. Vajrani V. N., Ratwani M. M. and Mehra H. Design and Analysis of Steel Structures, Oscar Publications.
2. Syal I. C. Design of Steel Structures, Standard Publishers Distributors, New Delhi Ramchandra, Non Linear Analysis of Steel Structures, Standard Publishers Distributors.
3. IS: 800-2007 & Steel Table.
4. Design of Steel Structures by Arya and Ajmani, Nem Chand Brothers Roorkee.
5. Ramachandra, Design of Steel structures, Vol. I & Vol. II, Standard Publishers Distributors,

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Water Treatment & Supply Systems	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Chemistry	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 33		**Tutorials = 00**	**Practical = 00**			

7. Brief Syllabus:

Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge of this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pre-treatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society along with knowledge of distribution of water and requirement of building plumbing.

8. Learning objectives:

1 Understand the basic principles and concepts of unit operations and processes involved in water treatment.

2. Understand the disinfection process in water treatment.

3. Understand the details of water supply systems.

4. To teach students pipe network design for the supply of water to the group of tenements.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Know the type of unit operations and processes involved in water treatment plants.

2. Understand unit operations and processes required for satisfactory treatment of water.

3. Know the design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.

4. Design water treatment units in a cost effective and sustainable way and to evaluate its performance to meet the desired health and environment related goals.

5. Design pipe network for water supply for residential and individual buildings

10. Unit wise detailed content

Unit-1	**Number of lectures =09**	**Title of the unit: Water Quality and Population estimation**

Water Quantity: Importance and necessity of water supply scheme. Water demands and its Variations. Estimation of total quantity of water requirement. Population forecasting. Selection of a source of water supply. Impurities in water and their sanitary significance. Physical and chemical properties of water, water quality standards.

Unit - 2	Number of lectures = 08	Title of the unit: Water Treatments Units and Disinfection System
Water Treatment: Objectives, treatment processes and their sequence in conventional treatment plant, sedimentation – plain and aided with coagulation. Filtration – mechanism involved types of filters, slow and rapid sand filtration units (features and design aspects), Disinfection principles and aeration. Other water treatment processes, purification processes in natural systems, water softening, removal of taste and odour, advanced methods of water treatment, deflouridation, and dissolved solids removal.		

Unit – 3	Number of lectures =08	Title of the unit: Water Conveyance System
Conveyance of water, Intake structures, Rising and Gravity system, Dual systems, Pumping Systems and pumping stations, valves and appurtenances, pipe materials and pipe fitting, O&M and troubleshooting for conveyance system.		

Unit - 4	Number of lectures = 08	Title of the unit: Water Distribution System
Layout of Distribution system – Dead End system, Grid Iron system, Ring system, Radial system, their merits and demerits Distribution Reservoir- functions and determination of storage capacity, Water Distribution Network, analysis of distribution network, layout, capacity and pressure requirements, leak detection, Maintenance, Water supply in buildings and plumbing.		

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

Text books

1. S.K Garg, Water supply Engineering (2010), 20th Edition, ISBN No. 81-7409-120-3, Khanna Publications.

1. Name of the Department: Civil Engineering Department						
2. Course Name	Design of Steel Structures-I Laboratory	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =		**Tutorials =0**	**Practical =28**			

7. Brief Syllabus:

Study of BIS Codes *i.e.* IS: 800-1984, IS: 800-2007 related to design of steel structures. Study of drawing of different types of connections, simple and built up beams, laterally supported and unsupported beams. The subject imparts knowledge of drawing of beams and columns.

8. Learning objectives:

1. To teach students drawing for the design of steel structures.
2. To make the students familiar with the concepts of steel drawing starting with riveted, welded and bolted connections and eccentric connections based on IS:800-1984 and IS:800-2007.
3. To teach the students drawing of tension, compression members and flexural members based on IS: 800-2007.
4. To teach students beam-column drawing as a whole for uniaxial and biaxial loading along with elastic theory of buckling of beams and columns.

9.Course Outcomes (COs):

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

1. Draw various members of steel structure in Auto Cad
2. Conceptualize & imagine the drawing of various sections according to need of drawing.

10.Unit wise lab detailed content

1. Structural Drawings of various types of welded connections (Simple and eccentric)
2. Beam to column connections
3. Column bases – slab bases –gusset base and grillage foundations.
4. Gantry girders Drawing
5. Roof trusses Drawing
6. Tension members and compression member.
7. Strut joints, tie joints, purlin joints.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Water Treatment & Supply Systems Lab	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Chemistry	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 00		**Tutorials = 00**	**Practical = 20**			

7. Brief Syllabus:

Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge of this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pre-treatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society along with knowledge of distribution of water and requirement of building plumbing.

8. Learning objectives:

1 Understand the basic principles and concepts of unit operations and processes involved in water treatment.

2. Understand the disinfection process in water treatment.

3. Understand the details of water supply systems.

4. To teach students pipe network design for the supply of water to the group of tenements.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Know the type of unit operations and processes involved in water treatment plants.

2. Understand unit operations and processes required for satisfactory treatment of water.

3. Know the design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.

4. Design water treatment units in a cost effective and sustainable way and to evaluate its performance to meet the desired health and environment related goals.

5. Design pipe network for water supply for residential and individual buildings.

10. List of Experiments

Sr. No.	**Title**	**CO covered**
1.	To determine the pH of a given water sample.	1,3
2	To determine the total solids, suspended solids, dissolved solids and volatile solids in wastewater.	1,2
3	To determine the turbidity and specific conductivity of the given water samples.	1,2

4	To determine the Alkalinity of given water sample.	1,2
5	To determine total hardness, permanent hardness and temporary hardness for given water sample.	1,3
6	To determine amount of sulphates in a given sample.	3
7	To determine the optimum dosage of coagulant for turbidity removal of a given water sample.	3,4
8	Determination of BOD	2
9	Determination of COD	3
10	To determine amount of Fluorides in a given sample.	4

Departmental Elective VII

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Principle of Geomatics**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures =42		**Tutorials = 00**	**Practical = 00**			

7. Learning objectives:

1. Distinguish the different types of surveying.
2. Identify and compute errors in land measurements.
3. Evaluate land elevation measurement according

8. Subject Outcomes: On completion of this course, the students will be able to

1. Be able to set up and use an automatic level.
2. Analyze land traverse computation.
3. Be able to set up and use total station for determining horizontal/vertical angles and coordinates of sighted points.
4.

9. Unit wise detailed content

Unit-1	**Number of lectures = 09**	**Title of the unit:** Adjustment of Observations

Geomatics engineering methodology and estimation. Accuracy and precision; errors and their propagation. Classes and combination of mathematical models; undetermined, uniquely determined and over determined models. Weight matrix; variance factor; covariance propagation. Least squares methods: parametric, condition and combined cases.

Unit – 2	**Number of lectures = 08**	**Title of the unit:** Data Analysis

Data classification, analysis and bias identification. Kalman filtering and real-time data analysis. Introduction to signal processing, time series analysis and FFT techniques Practical applications of data analysis and processing in Geomatics engineering.

Unit – 3	**Number of lectures = 08**	**Title of the unit:** Geodesy

Concepts of geodesy; size and shape of the Earth; geoid and ellipsoid; terrestrial, celestial and orbital coordinate systems; coordinate transformations; computations of positions in three dimensions; computations of positions on the ellipsoid and on a conformal mapping plane; azimuthal, conic and cylindrical projections, UTM and 3TM; Canadian horizontal and vertical datums; height determination.

Unit – 4	**Number of lectures = 08**	**Title of the unit:** Positioning

Static and kinematic positioning with the Global Positioning System (GPS). Elements of inertial positioning; time systems; astronomic positioning; VLBI positioning; orbit computations; satellite

laser ranging. Horizontal, vertical and three-dimensional networks; pre-analysis and post-analysis; theory of heights; gravimetry; global and local geoid determination; astrogeodetic, gravimetric and combined methods; levelling by GPS and the geoid.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Mikhail, E.M., *Observations and Least-squares*. Thomas Y. Crowell, New York, 1976.
2. Vanicek, P. and E.J. Krakiwsky, *Geodesy: The Concepts, (Parts IV and V)*. E.J. North Holland Publishing Co., 1986. ISBN 0444877770.

<table>
<tr><td colspan="8">1. Name of the Department: Civil Engineering Department</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Principle of Geomatics Laboratory</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>0</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE(√)</td><td colspan="2">OE()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>Odd ()</td><td>Either Sem ()</td><td>Odd (√)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 28</td><td>Tutorials =0</td><td colspan="4">Practical =0</td></tr>
<tr><td colspan="8">7. Learning objectives:
1. Distinguish the different types of surveying.
2. Identify and compute errors in land measurements.
3. Evaluate land elevation measurement according</td></tr>
<tr><td colspan="8">8. Subject Outcomes: On completion of this course, the students will be able to
1. Be able to set up and use an automatic level.
2. Analyze land traverse computation.
3. Be able to set up and use total station for determining horizontal/vertical angles and coordinates of sighted points.</td></tr>
<tr><td colspan="8">10. Unit wise detailed content
1. Study the Geomatics engineering methodology and design estimation
2. Explore any two models for the purpose of Accuracy and precision in reading for minimizing the error.
3. Apply least squares method for calculating the observation adjustment.
4. Examine the use Kalman filtering and real-time data analysis.
5. To examine practical applications of data analysis and processing in Geomatics engineering.
6. To study and verify Concepts of geodesy.</td></tr>
</table>

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Rock Mechanics**	L	T		P	
3. Course Code		3	0		4	
4. Type of Course (use tick mark)		Core (✔)	PE()		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =37		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

Rock mechanics includes the testing methods of rock ,rock mass classification, in-situ testing and methods to improve the engineering properties of rock mass

9. Learning objectives:

1-To study and analyze the laboratory and field testing for a given project / construction

2 -To analyze the appropriate methods to improve stability of rock mass

10. Course Outcomes (COs):

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

1. Understand the laboratory method required for determination of rock properties
2. Concept of Discontinuities in rock mass
3. Understand strength and stability behaviour of rocks
4. Application and recent development in the field of soil mechanics

11. Unit wise detailed content

Unit-1	**Number of lectures =10**	**Title of the unit: Introduction and Laboratory Testing methods**

Introduction: Rock: Formation of rocks, Physical properties, Classification of rocks and rock masses, Elastic constants of rock; In-situ stresses in rock.

Laboratory Testing methods study: Rock sampling, Determination of density, Porosity and Water absorption, Uniaxial Compressive strength, Determination of elastic parameters, Tensile strength, Shear Strength, Flexural strength, Strength criterion in rocks, Swelling and slake durability, permeability, point load strength, Dynamic methods of testing, Factors affecting strength of rocks.

Unit – 2	**Number of lectures = 08**	**Title of the unit: Discontinuities in Rock Masses**

Discontinuities in Rock Masses: Discontinuity orientation, Effect of discontinuities on strength of rock ;

Unit – 3	Number of lectures =10	Title of the unit: In – Strength and failure criterion of Rock
Strength Behaviour: Compression, Tension and Shear, Stress-Strain relationships, Rheological behavior ; **Strength/ Failure Criterion:** Mohr-Coulomb, Griffith theory, strength and other strength criteria. Stresses in rock near underground openings.		
Unit – 4	**Number of lectures = 09**	**Title of the unit: Rock application and recent development in rock mechanics**
Application of rock mechanics: Rock tunneling, rock slope stability, bolting, blasting, grouting and rock foundation design. Modern modelling techniques & analyses in rocks.		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i) Central Board of Irrigation and Power - Manual on Rock Mechanics, 1988.

ii) R. E. Goodman, "Introduction to Rock Mechanics" John Wiley & Sons, New York, 1989.

iii) Wakter Wittke, "Rock Mechanics" Springer Verlag, New York, 1990.

iv) Kiyoo Mogi "Experimental Rock Mechanics" Taylor & Francis Group, UK, 2007.

v) T. Ramamurthy, "Engineerng in Rocks for slopes, foundations and tunnels", PHI Learning Pvt. Limited, 2010.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Rock Mechanics Lab	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		Core ()	PE()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 37		**Tutorials = 00**	**Practical = 08**			

7. Learning objectives:

1-To study and analyze the laboratory and field testing for a given project / construction

2 -To analyze the appropriate methods to improve stability of rock mass

8. Course Outcomes (COs):
At the end of the lab course student able to
1-Understand the laboratory method required for determination of rock properties
2-Concept of Discontinuities in rock mass
3-Understand strength and stability behaviour of rocks
4-Application and recent development in the field of soil mechanics

9. Unit wise detailed content(Tutorial / Extended Tutorial /presentation/Case study components/laboratory)

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Study phenomenon of rock formation
2	Determination of physical properties of rocks
3	Calculation of in-situ stresses in rocks
4	Rock sampling methods
5	Study about discontinuities of rock mass
6	Laboratory study to determine strength characteristics of rocks
7	Recent development to improve the stability of rocks
8	Modern modelling techniques & analyses in rocks.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	**Reinforced Concrete Structures-II**	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		**Core ()**	**PEIII()**		**OE()**	
5. Pre-requisite (if any)	Concrete Technology, Structure Analysis	**Frequency (use tick marks)**	Even ()	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
7. Lectures = 34		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus:

Course contains learning of concept of working stress method and limit state method for various reinforced concrete sections. It includes concept of design of one way, two way and circular slabs, short column and long column, axially and eccentrically loaded columns. Students will understand the concept of footings and retaining wall design as well.

8. Learning objectives:

1 The students will be made familiar with the design of Flat slab, Domes, beams, beams curved in plan, water tanks, bunker, silos, chimney etc.

2. To enable the students to understand the various design philosophies of R.C.C. structures in practice.

9. Course Outcomes: On completion of this course, the students will be able to

1. Design above mentioned R.C.C structures on their own.
2. Use relevant BIS codes related to above mentioned R.C.C structures respectively.

10. Unit wise detailed content

Unit-1	**Number of lectures =10**	**Title of the unit: Flat Slab**

Introduction, Components of flat slab, Design of flat slab by direct and equivalent frame method based on IS: 456-2000, Opening in flat slab and detailing of reinforcement.

Beam curved in plan: Design and analysis of beam curved in plan supported symmetrically, design of semi-circular beam for different supports conditions, Torsion Factor, Stress due to torsion, reinforcement required for torsion. Recommendation of IS: 456.

Unit – 2	**Number of lectures = 10**	**Title of the unit Dome and Beam Curved in Plan**

Dome: Introduction**,** Stresses in spherical dome due static and wind load, Design of RCC spherical dome. Circular Tank: Introduction, General design requirements according to IS: 3370-II. Joints in water tank, circular tank with flexible joint between floor and wall as well as rigid joint between floor and wall. IS code provisions for circular tank

Rectangular Tank: Introduction, Approximate method and exact method, Underground tank: Introduction, earth pressure and uplift pressure on wall and floor respectively, design of rectangular tank.

Unit – 3	**Number of lectures =10**	**Title of the unit: Water Tank**

Introduction, Jannsen's and Airy's Theory, Rectangular and Circular water tank. Design of bunker, Conical and Pyramidal hoppers.		
Unit – 4	**Number of lectures = 12**	**Title of the unit: Pre-stress concrete**
Basic concepts – Advantages – Materials required – Systems and methods of pre-stressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections -Losses of pre-stress – Estimation of crack width.		

11. Books Recommended

Text books

1. 1. R.C.C Designs by B.C. Punmia and A.K. Jain, Laxmi Publication.
2. Design of Reinforced Concrete Structures,P.Dayaratnam, Oxford& IBH Publication New Delhi.
3. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
4. Reinforced Concrete Design, S.N.Sinha, TMH Publication, NewDelhi.
5. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi

Reference books

1. SP-16(S&T)-1980, Design Aids for Reinforced Concrete to IS: 456, BIS, N.Delhi.
2. SP-34(S&T)-1987 Handbook on Concrete Reinforcement and Detailing`, BIS
3. Reynold's Hand book for Reinforced cement concrete.
4. Reinforced Concrete, I. C. Syal &A ,K, Goel, A..H, Wheeler & Co. Delhi.
5. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi.

<table>
<tr><td colspan="2">1. Name of the Department</td><td colspan="6">CIVIL ENGINEERING</td></tr>
<tr><td>2. Subject Name</td><td>Reinforced Concrete Structures-II Lab</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td>3. Subject Code</td><td></td><td>0</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="2">4. Type of Subject</td><td>Core (√)</td><td colspan="2">PE()</td><td colspan="2">OE()</td></tr>
<tr><td>5. Pre-requisite (if any)</td><td>Reinforced Concrete</td><td>Frequency (use tick marks)</td><td>Even ()</td><td>Odd (√)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 00</td><td colspan="2">Tutorials = 00</td><td colspan="2">Practical = 28</td></tr>
<tr><td colspan="8">7. Brief Syllabus:
To make the students capable of drawing the reinforcement and preparation of drawing of T beam, L beam sections, rectangular beam sections, and different types of slabs, columns and footings.</td></tr>
<tr><td colspan="8">8. Learning objectives:
1. To provide students detailing of R.C.C members.
2. To make the students aware of how to communicate the detailing of reinforcement in the structural Members of RCC for the execution purpose.
3. To study drawings in field for the execution of Civil Projects.</td></tr>
<tr><td colspan="8">9. Course Outcomes (COs):
On completion of this course, the students will be able to
1. Prepare the detailed drawing of different RCC members.
2. They will also be able to read the detailed drawing of any Civil Engineering projects when made Project in charge.</td></tr>
<tr><td colspan="8">10. Unit wise lab detailed content</td></tr>
<tr><td colspan="8">1. Reinforcement detailing of Components of flat slab.
2. Reinforcement detailing of Opening in flat slab.
3. Reinforcement detailing of Beam curved in plan.
4. Reinforcement detailing of semi-circular beam for different supports conditions.
5. Reinforcement detailing of required for torsion.
6. Reinforcement detailing for Rectangular water tank.
7. Details of reinforcement for Circular Water tank.
8. Casting & testing of pre-stress member.</td></tr>
</table>

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Contract, Laws and Regulations**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	**Frequency (use tick marks)**	Even ()	Odd (√)	**Frequency (use tick marks)**	Even ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

This Course will introduce theoretical and practical aspects of construction management techniques to achieve project goals. & possess organizational and leadership capabilities for effective management of construction projects

8. Learning objectives:

1. To study the various types of construction contracts and their legal aspects and provisions.
2. To study the tenders, arbitration, legal requirement, and labor regulations.

9. Subject Outcomes:

On completion of this course the students will know different types of contracts in construction, arbitration and legal aspect and its provisions.

10. Unit wise detailed content

Unit-1	**Number of lectures = 09**	**Title of the unit:** CONSTRUCTION CONTRACTS

9 Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.

Unit - 2	**Number of lectures = 08**	**Title of the unit:** TENDERS

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines

Unit - 3	**Number of lectures = 08**	**Title of the unit:** ARBITRATION

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs.

Unit - 4	**Number of lectures = 08**	**Title of the unit:** LEGAL REQUIREMENTS & LABOUR REGULATIONS

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land

Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations. Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. Vohra, N.D. "Quantitative Techniques in Management ", Tata McGraw Hill Co., Ltd, New Delhi, 2000.

Referance books

3. Frank Harrison, E., "The Managerial Decision Making Process ", Houghton MiffinCo.Boston
4. Varshney, R.L. and Maheswari, K.L., "Managerial Economics ", Sultan Chand, 2005.
5.

1. Name of the Department		**CIVIL ENGINEERING**					
2. Subject Name	**Contract, Laws and Regulations Lab**	**L**	**T**		**P**		
3. Subject Code		0	0		2		
4. Type of Subject		Core ()	PE-XV()		OE()		
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()	

6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 00	**Tutorials = 00**	**Practical = 28**

7. Learning objectives:

1. To study the various types of construction contracts and their legal aspects and provisions.
2. To optimize the time of construction of a project by project planning tools.
3. To update the planners at site for material resources, time scheduling and project cost.

8. Course Outcomes (COs):

At the end of the lab course student able to

9. Subject Outcomes:

On completion of this course the students will know different types of contracts in constructio arbitration and legal aspect and its provision

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	International Contract Document
2	World Bank Procedures and Guidelines
3	Study of Contractual and Commercial Points of View
4	Appointment of Arbitrators – Conditions of Arbitration
5	Local Government Laws for Approval – Statutory Regulations
6	Study of laws of relating to Wages, Bonus and Industrial Disputes

1. Name of the Department: Civil Engineering						
2. Subject Name	Disaster Management	**L**	**T**		**P**	
3. Subject Code		3	0		4	
4. Type of Subject (use tick mark)		**Core ()**	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery. Learner will be able to understand Mitigation and Management techniques of Disaster as well.

8. Learning objectives:

1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management.
3. To build skills to respond to disaster.
4. To aware about Mitigation and Management techniques of Disaster.
5. To develop awareness through program and project on disaster management.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Share basic conceptual understanding of disasters and its relationships with development.
2. Understand approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
3. Enhance awareness of Disaster Risk Management institutional processes in India.
4. To understand Medical and Psycho-Social Response to Disasters.
5. Build skills to respond to disasters.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Definition and types of Disaster**

Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Study of Important Disaster**

Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g.) Earthquakes, Landside). Social Economics and Environmental impact of disasters.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Mitigation and Management techniques of Disaster**
Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, building design and construction in highly seismic zones, retrofitting of buildings.		
Unit - 4	**Number of lectures = 8**	**Title of the unit: Training, awareness program and project on disaster management**
Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in Sikkim and its surrounding areas. Exposure to applications based on current industrial trends.		
11. Books Recommended (3 Text Books + 2-3 Reference Books)		
1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)		
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.		
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.		
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.		
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.		

1. Name of the Department: Civil Engineering						
2. Course Name	Disaster Management Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward Disaster Management system. In addition to that, this course will inculcate the understanding about parameters involved in the determination of Disaster in an area.

8. Learning objectives:

1. Understand the processes for determination of disaster variables.
2. To gain insight into basic concept of disaster management.
3. Understand the parameter involved in determination of disaster in an area.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of variables of disaster management.
2. Apply the understanding of analytical techniques toward parameters that control disastrous effects.

8. Unit wise detailed content

1. To perform the hazard mapping.
2. To implement and enforcing building codes toward disaster management.
3. To perform the Flood plain mapping.
4. To demonstrate the Earthquake Location and Magnitude.
5. To demonstrate the Worldwide Earthquake Activity and Distribution.
6. Standard Penetration Test.
7. Determination of Relative Density.
8. To demonstrate the Disaster Causes in Mountain sites
9. To demonstrate the flood causing factors in Bihar, Kosi river.
10. To demonstrate the disastrous effect of tsunami.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Railway and Tunnel Engineering**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Surveying and Highway Engineering	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials =**	**Practical**			

7. Brief Syllabus:

This course imparts the student's knowledge of planning, design, construction and maintenance of railway tracks and designing and construction of tunnel engineering. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway and Tunnel Engineering.

8. Learning objectives:

4. To develop the understanding of Railway track design.
5. To develop the understanding of Tunnel designing and construction.
6. To Airport Engineering.

9. Subject Outcomes:

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

1. Appreciate the importance of railways to the development of a country
2. Know the different types of railway tracks; railway fastenings & maintenance of tracks.
3. Understand the importance of ground investigation in tunnel engineering.
4. Understand the importance of tunnel construction techniques.

10. Unit wise detailed content

Unit-1	**Number of lectures = 12**	**Title of the unit: Introduction to railway and survey for railway track**

Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS - Engineering Surveys for Track Alignment – Obligatory points - Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipment) - Permanent Way, its Components and their Functions:

Unit - 2	**Number of lectures = 14**	**Title of the unit: Elements of railway track and its design**

Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks -Sleepers – Functions, Materials, Density – Functions, Materials, Ballast less Tracks - Geometric Design of Railway Tracks – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves.

Unit - 3	Number of lectures = 08	Title of the unit: Introduction to tunnel engineering
Tunneling Methods: Types and purpose of tunnels; factors affecting choice of excavation technique; Methods – soft ground tunneling, hard rock tunneling,		
Unit - 4	**Number of lectures = 08**	**Title of the unit: Types of tunneling and method for excavation**
shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered in tunneling and remedial measures.		

11. Books Recommended

Text Books

1. Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998.
2. Driving Horizontal Workings and Tunnel, by Pokorovski, Mir Publishers, 1980.

References

1. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
2. Oza.H.P. and Oza.G.H., "A course in Docks &Harbour Engineering". Charotar Publishing Co.1976
3. Drilling and Blasting of Rocks, by Carlos L Jimeno, A.A. Balkema/Rotterdam/Brookfield 1995.

1. Name of the Department: Civil Engineering Department						
2. Course Name	Railway and Tunnel Engineering lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Surveying lab	Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials =0**	**Practical =28**			

7. Brief Syllabus: This course imparts the student's knowledge of planning, design, construction and maintenance of railway tracks and designing and construction of tunnel engineering. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway and Tunnel Engineering.

8. Learning objectives:

1. To impart the practical knowledge in Railway Engineering
2. To impart the practical knowledge in Tunnel Engineering
3. Students will learn the surveying techniques for railway engineering

7. Course Outcomes (COs):

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

1. Understand the importance of various railway track elements.
2. Understand the importance of geo-technology in tunnel engineering.
3. Learn surveying using total station.

8. Unit wise detailed content

1. Topographic profiling using total station.
2. Field visit to railway sleeper manufacturing site.
3. Field visit to Tunnel construction site.
4. Contour surveying using total station.
5. Understanding earth geography for tunnel using models

Departmental Electives-VIII

1. Name of the Department: Civil Engineering Department						
2. Course Name	Geotechnical Earthquake Engineering	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core ()	PE-VIII(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =42		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

This course covers the fundamentals of geotechnical earthquake engineering ,nature and types of earthquake loading, basics of vibration theory, strong ground motion and Seismic Analysis and Design of Various Geotechnical Structures

9. Learning objectives:

To understand the scope and objective of geotechnical earthquake engineering and Seismic Analysis and Design of Various Geotechnical Structures

10. Course Outcomes (COs):

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

1.Characterize and classify the nature and earthquake loading.

2- Understand the concept of dynamic loading, single degree of freedom system and multiple degree of freedom system,free and forced vibration, damped and undamped system

3-Analyse the factors involve in strong ground motion

4. Use seismic and vibration concept to Seismic Analysis and Design of Various Geotechnical Structures

11. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:** Introduction to Geotechnical Earthquake Engineering

Scope and objective; Nature and types of earthquake loading; Importance of Geotechnical Earthquake Engineering

Unit - 2	**Number of lectures = 08**	**Title of the unit:** Basics of Vibration theory

Concept of dynamic load, Earthquake load, Single degree of freedom system, Multiple degree of freedom system, Free and forced vibrations, Damped and undamped systems, Equation of Motion, Response spectra.

Unit - 3	Number of lectures = 10	Strong Ground Motion
Size of Earthquake: Magnitude and Intensity of Earthquake, Modified Mercalli Intensity Scale, Measuring of Earthquake, Earthquake Magnitude, Local (Richter) magnitude, surface wave magnitude, Moment magnitude, Seismic energy, Correlations. Spectral Parameters: Peak acceleration, Peak Velocity,Peak Displacement, Frequency Content and duration, Spatial Variability of Ground Motion, Attenuation Relationships, Fourier Amplitude Spectra, Arias Intensity.		

Unit - 4	Number of lectures = 14	Title of the unit: Seismic Analysis and Design of Various Geotechnical Structures
Pseudo-static method, Pseudo dynamic method, other dynamic methods, Seismic analysis of retaining wall, Seismic slope stability analysis, Behaviour of reinforced soil under seismic conditions, Seismic design of retaining structures, Seismic analysis of Tailings Dam, Seismic displacement based analysis, seismic design of shallow foundations, seismic design of pile foundations, seismic uplift capacity of ground anchors, seismic design of Municipal Solid Waste (MSW) landfills		

12. Books Recommended (3 Text Books + 2-3 Reference Books)

i)Shamsher Prakash,"Soil Dynamics", McGraw-Hill Book Company.

ii) Geotechnical Earthquake Engineering by Kamalesh Kumar, New Age International Pvt Ltd Publishers, SBN: 9788122436907, 9788122436907

iii) Robert W. Day,"Geotechnical Earthquake Engineering Handbook", McGraw Hill, New York.

iv) Kenji Ishihara,"Soil Behaviour in Earthquake Geotechnics", Oxford University Press, USA

v) D. D.Barkan,"Dynamics of Bases and Foundations", McGraw-Hill Book Company.

1. Name of the Department: Civil Engineering Department						
2. Course Name	Geotechnical Earthquake Engineering Laboratory	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	PE-VIII(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even (✔)	Odd ()	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =32		**Tutorials =0**	**Practical =07**			

8. Brief Syllabus

This course covers the fundamentals of geotechnical earthquake engineering ,nature and types of earthquake loading, basics of vibration theory, strong ground motion and Seismic Analysis and Design of Various Geotechnical Structures

9. Learning objectives:

To understand the scope and objective of geotechnical earthquake engineering and Seismic Analysis and Design of Various Geotechnical Structures

10. Course Outcomes (COs):

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

1.Characterize and classify the nature and earthquake loading.

2- Understand the concept of dynamic loading, single degree of freedom system and multiple degree of freedom system, free and forced vibration, damped and undamped system

3-Analyse the factors involve in strong ground motion

4. Use seismic and vibration concept to Seismic Analysis and Design of Various Geotechnical Structures

11. Unit wise detailed content

1- To study about earthquake loading

2- Analysis of single degree of freedom system

3- Analysis of multiple degree of freedom system

4- Damped and undamped system

5- Dynamic load test

6- Measurement of Magnitude and Intensity of Earthquake

7- Study about Behaviour of reinforced soil under seismic conditions

1. Name of the Department	**CIVIL ENGINEERING**					
2. Subject Name	**Bridge Engineering**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)			**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 33		**Tutorials =0**	**Practical =0**			

7. Brief Syllabus:

Introduction to history of bridge-building, including types of bridges, aesthetics, and materials for modern bridges; Loadings on bridges including standard truck and lane loading, impact loads, longitudinal and centrifugal forces, wind and seismic loads, thermal loads; Serviceability criteria including deflection and fatigue; Design of reinforced concrete bridges, slab bridges, concrete slab with steel stringer bridges, T-beam or plate girder bridges, box girder bridges, and prestressed concrete bridges; Bridge maintenance including inspection and rehabilitation.

8. Learning objectives:

1. To discuss basic definitions, types, and components of bridges.
2. To discuss sub-surface investigations required for bridge construction.
3. To understand standard specification for bride design.
4. To perform design of various slab type reinforced concrete bridges.
5. To perform design of bridges sub-structures, bearings and joints.
6. To have knowledge of quality control and maintenance aspects of bridges.

9. Subject Outcomes:

Upon successful completion of this course, it is expected that students will be able to:

1. Relate different design philosophies of the highway and railway bridges.
2. Understand the structural behavior of different components of a reinforced concrete and steel bridge.
3. Analyze and design different components of a highway and railway bridge, to meet desired needs within realistic constraints such as economy, environment friendly, safety, viable construction and its sustainability under loads standardized by Indian Road Congress (IRC) and Indian Railway Standard Code of Practice for Bridges respectively and submit the designs in complete and concise manner.
4. Use the techniques, skills, and modern engineering tools and software necessary for design and detailing.
5. Analyze and interpret the results using analytical tools and further plan, design and detail different bridges using relevant and upcoming BIS standards.
6. Interact and manage work with professionals of diverse background and talent.

10. Unit wise detailed content

Unit-1	**Number of lectures =**	**Title of the unit: Concrete Bridges**

	08	

Introduction-Types of Bridges-Economic span length-Types of loading-Dead load live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements

Unit – 2	**Number of lectures = 12**	**Title of the unit: Solid slab Bridges and Girder Bridges**

Introduction-Method of Analysis and Design
Introduction-Method of Analysis and Design- Courbon's Theory, Grillage analogy

Unit – 3	**Number of lectures = 12**	**Title of the unit: Pre-Stressed Concrete Bridges**

Basic principles-General Design requirements-Mild steel reinforcement in prestessed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams Composite Section-Propped-Design of Propped Composite Section-Unproped composite section-Two stage Prestress ing-Shrinking stresses-General Design requirements for Road Bridges.

Unit – 4	**Number of lectures = 10**	**Title of the unit :Analysis of Bridge Decks**

Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. Victor (2012) "Essentials of Bridge Engineering"7th Edition, ISBN No. 978-043-89-98, Oxford, New Delhi, India

Reference books

1. Standard Specifications and Code of Practice for Railway Bridges a. Indian railway Standard Code of Practice for the Design of Steel or Wrought Iron Bridges carrying Rail, Road or Pedestrian Traffic, Govt. Of India, Ministry of Railways, 1962 b. Indian railway Standard Code of Practice for Reinforced Concrete Construction, Govt. Of India, Ministry of Railways, 1962.
2. I.S: 875-1987 Part 1 and 12 - Code of Practice for Design loads for Buildings and Structures, BIS, New Delhi, India.
3. I.S: 1893 2002- Indian Standard Code of Practice for Structural Safety of Structures, BIS, New Delhi, India.
4. S.P.:34- Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi, India.

<table>
<tr><td colspan="8">1. Name of the Department CIVIL ENGINEERING</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Bridge Engineering Lab</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td></td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td colspan="3">4. Type of Course</td><td>Core ()</td><td colspan="2">PE(√)</td><td colspan="2">OE()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td>Reinforced Concrete Structures</td><td>6. Frequency (use tick marks)</td><td>Even (√)</td><td>Odd ()</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 28</td><td>Tutorials =00</td><td colspan="4">Practical = 00</td></tr>
<tr><td colspan="8">8. Brief Syllabus:
Design of reinforced concrete bridges is normally done on the basis of a structural analysis. The purpose of the analysis is to find a distribution of sectional forces which fulfils equilibrium and is suitable for design.</td></tr>
<tr><td colspan="8">9. Learning objectives:
1. To discuss basic definitions, types, and components of bridges.
2. To discuss the load distribution and IRC standards.
3. To understand standard specification for bride design.
4. To perform design of various slab type reinforced concrete bridges.</td></tr>
<tr><td colspan="8">10.Course Outcomes: On completion of this course, the students will be able to
1. Understand the load distribution and IRC standards
2. Design the slab bridges
3. Design the Arch bridges
4. Design the bridge bearings and joints</td></tr>
<tr><td colspan="8">11.Unit wise detailed content</td></tr>
<tr><td colspan="8">1. Study IRC Codes for Loading.
2. Study IRC codes for Highway bridge design.
3. Understanding various methods of analysis.
4. Industrial visit to various industrial sites to understand the different types of Bridges.
5. Study Pocket book for Bridge Engineer.</td></tr>
</table>

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Concrete Construction Technology**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	**Frequency (use tick marks)**	Even ()	Odd (√)	**Frequency (use tick marks)**	Even ()	Every Sem ()

6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)

Lectures = 42	**Tutorials = 00**	**Practical =00**

7. Brief Syllabus:

Concrete is a construction material composed of cement, fine aggregates (sand) and coarse aggregates mixed with water which hardens with time. In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing elements.

8. Learning objectives:

1.

9. Subject Outcomes:

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit:** Introduction

Introduction of Concrete materials, Admixtures, Fly Ash, Polymers, Early Age Properties, Strength, Permeability & Durability

Principles of Concrete mix design, Concrete Mix Design procedure by: IS/ACI/British Standards.

Unit - 2	**Number of lectures = 10**	**Title of the unit:** Concreting Operations

Concreting Operations-Practices and Equipment, Batching; Mixing; Transporting; Placing and Compacting; curing.

Properties and technique of construction for concrete, Fiber reinforced concrete, light weight concrete, Heavy weight concrete, Foam concrete, High performance Concrete.

Unit - 3	**Number of lectures = 10**	**Title of the unit:** Special concrete operations

Special concrete operations, shot Crete, grouting, Grunting, under water concreting, hot and cold weather concrete, pumpabale concrete. 6. Construction techniques for reinforced concrete elements-materials, Principles and procedures for beams, slabs, columns, Foundations, walls and tanks, design and fabrication of form work for R.C.C elements.

Unit - 4	**Number of lectures = 12**	**Title of the unit:** Prestressed concrete construction

Prestressed concrete construction-Principle, methods, materials, Tools and equipment for the

construction of a prestressed bridge.
Inspection and Quality Control of Concrete Construction-Stages, Principles, Checklist, Statistical Controls, procedures.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. Concrete Technology by M.L. Gambhir Tata McGraw Hill Co., Ltd, New Delhi, 2000.

Referance books

6. Frank Harrison, E., “The Managerial Decision Making Process ", Houghton MiffinCo.Boston
7. Varshney, R.L. and Maheswari, K.L., “Managerial Economics ", Sultan Chand, 2005.

1. Name of the Department	**CIVIL ENGINEERING**					
2. Subject Name	**Concrete Construction Technology Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-XV()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			
7. Learning objectives:						
8.Course Outcomes (COs):						
At the end of the lab course student able to						
9. Subject Outcomes: Concrete is a construction material composed of cement, fine aggregates (sand) and coarse Aggregates mixed with water which hardens with time. In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing Elements.						
9. Unit wise detailed content						
10. Tutorial / Extended Tutorial /Case study components/laboratory						

Sr. No	**Title**
1	Testing of aggregates-fine and coarse as per BIS procedure.
2	Testing of cement with reference to IS specifications and Cement Grade.
3	Concrete Mix Design for desired grade from given materials.
4	Design and testing of workability of concrete for a given C.C. proportion.
5	Design and determination of Cube Strength with given materials and proportions
6	Study of effect of compaction of strength of concrete.
7	Conduct chemical analysis of hardened concrete to determine the cement content.
8	Inspection of a concrete construction site and preparation of report showing correct and incorrect practices.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Theory and Applications of GIS**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 33		**Tutorials = 00**	**Practical = 00**			

8. Learning objectives:

- Maximize the efficiency of decision making and planning.
- Provide efficient means for data distribution and handling.
- Elimination of redundant database-minimize duplication.
- Capacity to integrate information from many sources.

9. Subject Outcomes:

- Explore mapped data.
- Relate GIS with remote sensing technologies.
- Analyze spatial data, using GIS analysis tools.
- Develop and manage geo data bases.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit:** Introduction to GIS Basic concepts:

Definition and history, Components of GIS, Recent trends and applications of GIS; Data structure and formats, Spatial data models – Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Data inputting in GIS. Rectification, Transformation Methods; Root Mean Square (RMS) Error.

Unit - 2	**Number of lectures = 10**	**Title of the unit:** Data Types and Data Models Data Types;

Spatial Data; Non-Spatial Data, Data Input; Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models; Vector Data Model; Raster Data Model; Integration and Comparison of Vector and Raster Data Models.

Unit - 3	**Number of lectures = 10**	**Title of the unit:** Spatial Data Editing

Types of Digitizing Errors, Causes for Digitizing Errors; Topological Editing and Non-topological Editing; Other Editing Operations; Editing Using Topological Rules.

Unit - 4	**Number of lectures = 12**	**Title of the unit:** Attribute Data and Data Exploration

Attribute Data in GIS, Attribute Data Entry, Manipulation of Fields and Attribute Data, Data

Exploration; Attribute Data Query, Raster Data Query, Map- Based Data Manipulation.

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. Irrigation Engineering and Hydraulic Structures (2011) 24th edition, ISBN No. 81-7409-047-9, S.K. Garg, Khanna Publications.

Reference books

1. Viessmen, Jr. & Lewis, Introduction to Hydrology, PHI Learning Private Ltd.
2. Agarwal, V.C. Groundwater Hydrology. PHI Learning Private Ltd.
3. Larry W. Mays, Water Resources Engineering. Wiley Publications.
4. Subramanya, K., Engineering Hydrology, Tata McGraw-Hill.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Theory and Applications of GIS Laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials =0**	**Practical =0**			

8. Learning objectives:

- Maximize the efficiency of decision making and planning.
- Provide efficient means for data distribution and handling.
- Elimination of redundant database-minimize duplication.
- Capacity to integrate information from many sources.

9. Subject Outcomes:

- Explore mapped data.
- Relate GIS with remote sensing technologies.
- Analyze spatial data, using GIS analysis tools.
- Develop and manage geo data bases.

10. Unit wise detailed content

1. Familiarization with Image Processing software.

2. Visualization; Import and export of Top sheet and satellite data to various formats.

3. Geo referencing of data- image to image, image to maps

4. Layer Stacking of Multispectral Imagery

5. Creating subset of image.

6. Resolution merge and Mosaic.

7. Displaying individual pixel value and image information. 8. Image enhancement techniques- image contrast, histogram equalization and density slicing.

1. Name of the Department: Civil Engineering						
2. Subject Name	Environment Impact Assessment	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subjects (use tick mark)		**Core ()**	**PE(√)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures= 42		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This course will cover various aspects of Environmental Impact Assessments (EIA). EIA provides a tool that assists in the anticipation and minimization of development's negative effects. Learner will be able to understand early stages of project planning and design, EIA helps shape development in a manner that best suits the local environment and is most responsive to human needs.

8. Learning objectives:

The objective of EIA is

1.To identify, predict and evaluate the economic, environmental and social impact of development activities.

2. To provide information on the environmental consequences for decision making.

3. To promote environmentally sound and sustainable development.

4. to impart knowledge of Socio-economic impact assessment

5. To aware about the role of public in EIA implementation.

9. Subject Outcomes:

On Completion of the course, students will be able to:

1. Able to apply the concept and methodology of EIA in current scenario.
2. Able to implement the various EIA techniques.
3. Able to impacts knowledge of Socio-economic impact assessment.
4. Able to identify the role of public participation in EIA.
5. Able to assess the Socio-economic impact.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Introduction**

Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. Types and limitations of EIA, Public Participation in EIA. EIA process screening, scoping, setting, analysis, mitigation

Unit - 2	**Number of lectures = 12**	**Title of the unit: Components and methods for EIA**

EIA Matrices, Networks, Checklists-Connections and combinations of processes, Cost benefit analysis-Analysis of alternatives, Software packages for EIA, Expert systems in EIA.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Socio-economic impact assessment**

Definition of social impact assessment. Social impact assessment model and the planning process. Rationale and measurement for SIA variables. Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition - neighbourhood and community impacts. Selecting, testing and understanding significant social impacts. Mitigation and enhancement in social assessment. Environmental costing of projects

Unit - 4	**Number of lectures = 8**	**Title of the unit: Environmental management plan**

Environmental Management Plan, Preparation, implementation and review, Mitigation and Rehabilitation Plans-Policy and guidelines for planning and monitoring programmes, Post project audit-Ethical and Quality aspects of Environmental Impact Assessment. Exposure to applications based on current industrial trends.

11. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.

2. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996.

3. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.

4. Environmental Impact Assessment, by R.R. Barthwal, New Age International Private Limited; 2nd edition (1 January 2012)

5. Environmental Impact Assessment: A Guide, by Charles H. Eccleston, CRC Press; 1st edition (29 March 2011).

1. Name of the Department: Civil Engineering						
2. Course Name	Environment Impact Assessment Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward environment impact assessment methods. In addition to that, this course will inculcate the understanding about parameters involved in the impact assessment.

8. Learning objectives:

1. Understand the processes for determination of environmental parameters.
2. To gain insight into basic concept of impact assessment.
3. Understand the parameter involved in determination of Environment Impact Assessment.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of Environment Impact Assessment.
2. Apply the understanding of analytical techniques toward parameters that influences environment.

8. Unit wise detailed content

1. Determination of Odour of a sample.
2. Determination of Colour of a sample.
3. Determination of pH of Water.
4. Determination of Oil and Grease in a sample.
5. Determination of Turbidity of Water.
6. Determination of Solids in Water.
7. Determination of Chloride Content in Water.
8. Determination of Phosphates and Sulphates
9. Determination of Iron and Fluoride
10. Determination of Oil and Grease.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Airport Planning and Design	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE (✔)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem (√)	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 12 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical =0**			

7. Brief Syllabus:

ICAO standard for airport and air traffic operation, Various safety standard for aircraft, Airport components, Zoning laws, Capacity and traffic determination, Runway design, Taxiway design, Marking & signal, Lighting.

8. Learning objectives:

1. Students will be able to understand the various airport components
2. Students will be able to understand the different techniques used for air traffic calculation
3. Students will learn about the various factors affecting the runway orientation
4.

9. Subject Outcomes:

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

1. Understanding the ICAO standards & regulations
2. Understanding the various design elements of an airport
3. Air traffic calculation
4. Runway design
5. Runway lighting design

10. Unit wise detailed content

Unit-1	**Number of lectures = 12**	**Title of the unit: Classification of airports**

ICAO standards. Planning for airport, airport components, zoning laws.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Air traffic forecasting**

Various methods of air traffic forecasting, Capacity determination.

Unit - 3	**Number of lectures = 10**	**Title of the unit: Runways Orientation and Geometric Design**

Runway patterns. Taxiways alignment geometry and turning radius exit taxiways

Unit - 4	**Number of lectures = 10**	**Title of the unit: Aprons Planning and Design**

Design principles of critical, semi-critical, non-critical airport pavements, and FAA and PCA methods. Airport hangars, their planning and design criteria.

11. Books Recommended

Text Books

(i) Airport Engineering, N.J. Ashford, P.H. Wright, John Wiley

(ii) Planning and Design of Airports, R.M. Horonjeff, F.X. McKelvey, W.J Sproule, Seth Young,

References

(i) Airport Planning & Management, Wells, Alexander; Young, Seth, McGraw Hill.

(ii) TMH International Publishers

(iii) Airport Engineering (Planning and Design), S.C Saxena, CBS Publisher

12. Tutorial / Extended Tutorial /presentation/Case study components

1. Name of the Department: Civil Engineering Department						
2. Course Name	Airport Planning and Design lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Even Sem (√)	Odd sem ()	Either Sem (√)	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials =0**	**Practical =0**			

7. Brief Syllabus:

Understanding ICAO guidelines, Study of the wind direction and development of wind diagram, Air traffic forecasting.

8. Learning objectives:

1. To impart the importance of various international rules and regulations for safe air travel.
2. Understand the various traffic forecasting techniques.
3. Understand the wind diagrams.

9. Course Outcomes (COs):

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

1. Students will understand various domestic and international guidelines related of air travel operations.
2. Students will able to forecast the air traffic.
3. Students will understand the importance of various runways marking.
4. Students will understand the importance of runway lighting.

10. Unit wise detailed content

1. Study of wind flow direction.
2. Development and study of wind flow diagram.
3. Study of air traffic management.
4. Study of air traffic forecasting techniques
5. Study of ICAO guidelines.
6. Study of runway marking.
7. Study of runway lighting system

7th Semester

Scheme of Examination for B.Tech(Civil Engineering) Program 4th year

SEMESTER WISE COURSE STRUCTURE 2021-2022 (Internship Based)

Seventh Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Estimation and Costing	3	0	0	3	40	60	100
2.		Department Electives-IX	3	0	0	3	40	60	100
3.		Department Electives-X	3	0	0	3	40	60	100
4.		Estimation and Costing Lab	0	0	2	1	60	40	100
5.		Department Electives Lab-IX	0	0	2	1	60	40	100
6.		Department Electives Lab-X	0	0	2	1	60	40	100
7.		Capstone Project	0	0	4	2	60	40	100
		Industrial Training-II	0	0	6w	3			
		Value Addition Course-IV	2	0	0	2			
		Total	**11**	**0**	**10**	**19**	**360**	**340**	**700**

Eighth Semester

S.NO.	Subject Code	Course Title	L	T	P	C	Examination marks		Subject Total
							Int.	Ext.	
1.		Industrial Internship with Project (Industrial oriented/Research oriented)	-	-	20 W	**10**	100	100	**200**
	Total Credits = 10/14*								
	Overall Total Credits = I to VIII= 160/176*								

***** A student will be eligible to get Under Graduate degree with **Honours**, if he/she completes an additional 16 credits. These can be acquired through SWAYAM MOOCs. For that, one MOOC Course of atleat 8 weeks (4 credits) must be completed during Fourth Year. The list of MOOC courses will be provided by the Departement to the students before commencement of the semester.

Sr. No	Specialization	Departmental Elective-IX	Departmental Elective-X
1	**Transportation Engineering**	Transportation Planning	Urban Transit System
2	**Water Resource Engineering**	Irrigation and Drainage	Environmental Hydraulics
3	**Geotechnical Engineering**	Advanced Geotechnical Exploration and Testing	Physico Chemical Behaviour of Soils
4	**Structural Engineering**	Design of Steel Structure-II	Earthquake Engineering
5	**Construction Management**	Disaster Reduction and Management	Maintenance of Building Structure
6	**Geo-Informatics and Remote Sensing**	Geoinformatics for Natural Disasters	Geoinformatics for Land use Surveys
7	**Environmental Engineering**	Design of waste water System	Water quality modeling

Exit Point

Under Graduate Degree in Civil Engineering with specialization in_____.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Estimation & Costing**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 33		**Tutorials = 00**	**Practical = 00**			

7. Learning objectives:

1. To teach the students quantity survey for the preparation of preliminary and detailed estimates.
2. To teach the students cost analysis of individual item above for the estimation purpose.
3. To make the students aware of those factors that affect the cost of construction work and to analyz the influences that effect change in these factors.
4. To inculcate habit of systematic recording of all those statistics which are required to maintai stocks in trade.

8. Subject Outcomes: On completion of this course, the students will be able to

1. Forecast the approximate cost of the projects through preliminary and detailed estimates.
2. Analyze the rates of individual items for the preparation of the estimates.
3. To record measurements of the finished products for the calculation of length, area, volume fo payment purpose.
4. Prepare schedule of quantities required to be attached with the tender documents.

9. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Estimate**

Principle of estimation, units, item work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two room building, multi storey buildings, with different sections of walls ,foundation, floors and roofs, R.B and R.C.C works, Plastering, white washing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, dams, barrages, Hilly roads etc.

Unit – 2	**Number of lectures = 10**	**Title of the unit: Specification of Works:**

Necessity of specification types of specification, general specification, specification of bricks, cement, sand, water, lime, reinforcement, detailed specification for earthwork, cement, concrete, brickwork, flooring,D.P.C, R.C.C, cement plastering, white and color washing, distempering, painting.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Rate analysis**

Purpose, importance and requirements of rate analysis, units of measurement preparation of rate analysis. Procedure of rate analysis for items: Earth work, concrete works, R.C.C works, reinforce brick work, plastering, painting, finishing (white washing, distempering).

Unit – 4	**Number of**	**Title of the unit:**

	lectures = 12	**Public Works Account, Billing and valuation**

Tender and acceptance of tender, Earnest money, security money, retention money, measurement book, cash book, preparation, examination and payment of bills, first and final bills, administrative sanction, technical sanction.

Billing: maintenance of muster role, preparation of pay bill, measurement of work for payment of contractors.

Different types of payment: first & final, running advance and final payment.

Valuation: Purpose of valuation, principles of valuation depreciation, sinking fund, salvage& scrap value, valuation of a building: cost method, rental –return method.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/

Journal papers; Patents in the respective field.

11. Books Recommended (3 Text Books + 2-3 Reference Books)

Text Books

1. Dutta BN, Estimating &costing(2013), 27th Edition, ISBN No. 978-81-7476-729-5, UBS Publications

Reference Books

1. Chakraborty, Estimate costing &specification in Civil Engineering.

2. Kohli & Kohli, Atext book on estimating &costing (Civil) with drawings Ambala Ramesh Publications

2. Rangwala SC Estimating &Costing, Anand Charotar Book Stall.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Estimation & Costing Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Survey	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Learning objectives:

5. To teach the students quantity survey for the preparation of preliminary and detailed estimates.
6. To teach the students cost analysis of individual item above for the estimation purpose.
7. To make the students aware of those factors that affect the cost of construction work and to analyz the influences that effect change in these factors.
8. To inculcate habit of systematic recording of all those statistics which are required to maintai stocks in trade.

8. Subject Outcomes: On completion of this course, the students will be able to

1. Forecast the approximate cost of the projects through preliminary and detailed estimates.
2. Analyze the rates of individual items for the preparation of the estimates.
3. To record measurements of the finished products for the calculation of length, area, volume fo payment purpose.
4. Prepare schedule of quantities required to be attached with the tender documents.

9. Unit wise detailed content

Sr. No.	Title	CO covered
1	One room estimation long wall short wall method	2
2	One room estimation Centre line method	2
3	Two room estimation long wall short wall method	2
4	Two room estimation Centre line method	2
5	Doors and windows provisions in estimation	2
6	Estimation for foundation of a multistory structure	2,3
7	Analysis of rate for brick work	2,3
8	Analysis of rate for plaster work	2,3
10	Estimate quantity of reinforcement	1,2
11	Preparation for appropriate estimate for road project	1,3
12	Estimating cost of building cost of building on plinth area method	3

Sr. No	Specialization	Departmental Elective-IX	Departmental Elective-X
1	**Transportation Engineering**	Transportation Planning	Urban Transit System
2	**Water Resource Engineering**	Irrigation and Drainage	Environmental Hydraulics
3	**Geotechnical Engineering**	Advanced Geotechnical Exploration and Testing	Physico Chemical Behaviour of Soils
4	**Structural Engineering**	Design of Steel Structure-II	Earthquake Engineering
5	**Construction Management**	Disaster Reduction and Management	Maintenance of Building Structure
6	**Geo-Informatics and Remote Sensing**	Geoinformatics for Natural Disasters	Geoinformatics for Land use Surveys
7	**Environmental Engineering**	Design of waste water System	Water quality modeling

Departmental Elective IX

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Transportation Planning**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Engineering Hydrology	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 33		**Tutorials = 00**	**Practical = 00**			

7. Brief Syllabus:

In this course, This course imparts the student's knowledge of planning, design, construction and maintenance of transportation and designing and construction of highway engineering.

8. Learning objectives:

1. Students will learn about the various material used in road construction.
2. Students able to understand that how to determine the various material characteristics
3. Understand the importance of quality of materials

9. Course Outcomes (COs):

1. At the end of the course, the student will be able to
2. Differentiate good and poor material for road construction
3. Understand material behavior under loading
4. Aggregate grading importance

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Role of transport**

Role of transport, types of transport systems, evolution of transport modes, transport problems and mobility issues , Urban form and Transport patterns, land use – transport cycle, concept of accessibility

Unit - 2	**Number of lectures = 10**	**Title of the unit: Hierarchy**

Hierarchy, capacity and geometric design elements of roads and intersections , Basic principles of Transport infrastructure design

Unit - 3	**Number of lectures = 10**	**Title of the unit: Traffic and transportation**

Traffic and transportation surveys and studies, traffic and travel characteristics, Urban transport planning process – stages, study area, zoning, data base, concept of trip generation

Unit - 4	**Number of lectures = 12**	**Title of the unit: Transport**

Transport, environment and safety issues, Principles and approaches of Traffic Management, Transport System Management.

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. Irrigation Engineering and Hydraulic Structures (2011) 24th edition, ISBN No. 81-7409-047-9, S.K. Garg, Khanna Publications.

Referance books

1. Viessmen, Jr. & Lewis, Introduction to Hydrology, PHI Learning Private Ltd.
2. Agarwal, V.C. Groundwater Hydrology. PHI Learning Private Ltd.
3. Larry W. Mays, Water Resources Engineering. Wiley Publications.
4. Subramanya, K., Engineering Hydrology, Tata McGraw-Hill.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Transportation Planning Laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials =0**	**Practical =0**			

7. Brief Syllabus:

In this course, This course imparts the student's knowledge of planning, design, construction and maintenance of transportation and designing and construction of highway engineering.

8. Learning objectives:

1. Students will learn about the various material used in road construction.
2. Students able to understand that how to determine the various material characteristics
3. Understand the importance of quality of materials

9. Course Outcomes (COs):

1. At the end of the course, the student will be able to
2. Differentiate good and poor material for road construction
3. Understand material behavior under loading
4. Aggregate grading importance

10. Unit wise detailed content

1. Estimate irrigation efficiency of nearby irrigation lands.
2. Study the nearby fields for their specific crops water requirements.
3. Explore the necessity of silt ejector and extruder.
4. Examine the Requirement of fields for sub surface irrigation.
5. Explore Necessity and classification of Dams and the selection of site of Dam.
6. Study the Hydraulic design of gravity dam and prepare one gravity dam design.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Irrigation and Drainage**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Engineering Hydrology	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 33		**Tutorials = 00**	**Practical = 00**			

7. Brief Syllabus:

In this course, the students will know the importance of irrigation system in India and water requirement of crops. They will also know the hydraulic design of various irrigation structures such as weir, barrage, cross drainage works, dams, silt ejector and excluder, earth dam, canal falls. They will know the various components of head works and head regulator.

8. Learning objectives:

1. To get the exposure about the use of water for the purpose of irrigation work in India.
2. They will know to plan and design the diversion head works, head regulator, canal system and other important features to be used in irrigation projects.
3. To understand the concept and design of water storage, flood control and river training work.
4. To have clear idea about different kind of energy dissipaters and desilting & overflow arrangements.

9. Subject Outcomes:

1. To calculate water requirement related to crops for different seasons in India.
2. Do hydraulic design of different components of irrigation projects.
3. They will learn different types of water storage works.
4. They will also learn to calculate and design flood control devices.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Water Requirements for Crops**

Irrigation requirements in India: Scope, Soil moisture & Plant growth, crop water requirements, Irrigation Scheduling, Irrigation efficiencies, Duty-Delta-base period & relation between them, Surface & subsurface irrigation method, Irrigation water Quality.

Unit - 2	**Number of lectures = 10**	**Title of the unit: Diversion head works**

Introduction, layout of diversion headwork and its component, khosla's theory and concept of flow net, safe exit gradient, hydraulic design of weir on Bligh's theory and design of modern barrage on khosla's theory. Necessity& functioning of silt excluder & silt extractor.

Unit - 3	**Number of lectures = 12**	**Title of the unit: Cross Drainage Work & Canal Falls**

Classification and selection of cross drainage work, hydraulic design aspects of aqueduct and syphon

aqueduct. Canal falls: Necessity and classification of canal falls, hydraulic design of Sarda type and a Straight Glacis fall.

Unit - 4	Number of lectures = 10	Title of the unit: Storage Head Works, Spillway and Energy Dissipation

Necessity and classification of Dams, Selection of site of Dam.

Gravity Dam: Introduction, Forces acting on Dam, Stability criterion, Elementary profile of dam, Drainage gallery, Hydraulic design of gravity dam.

Earth Dam: Introduction, design principle, seepage throughout dam, seepage line, control of seepage, and design of filter.

Necessity and classification of Spillway, essential requirements of spillways capacity and their suitability, Hydraulic design of Ogee spillway.

11. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/Journal papers; Patents in the respective field.

12. Books Recommended

Text Books

1. Irrigation Engineering and Hydraulic Structures (2011) 24th edition, ISBN No. 81-7409-047-9, S.K. Garg, Khanna Publications.

Referance books

1. Viessmen, Jr. & Lewis, Introduction to Hydrology, PHI Learning Private Ltd.
2. Agarwal, V.C. Groundwater Hydrology. PHI Learning Private Ltd.
3. Larry W. Mays, Water Resources Engineering. Wiley Publications.
4. Subramanya, K., Engineering Hydrology, Tata McGraw-Hill.

1. Name of the Department: Civil Engineering Department						
2. Course Name	**Irrigation and Drainage Laboratory**	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 28		**Tutorials =0**	**Practical =0**			

7. Brief Syllabus:

In this course, the students will know the importance of irrigation system in India and water requirement of crops. They will also know the hydraulic design of various irrigation structures such as weir, barrage, cross drainage works, dams, silt ejector and excluder, earth dam, canal falls. They will know the various components of head works and head regulator.

8. Learning objectives:

5. To get the exposure about the use of water for the purpose of irrigation work in India.
6. They will know to plan and design the diversion head works, head regulator, canal system and other important features to be used in irrigation projects.
7. To understand the concept and design of water storage, flood control and river training work.

To have clear idea about different kind of energy dissipaters and desilting & overflow arrangements.

9. Subject Outcomes:

5. To calculate water requirement related to crops for different seasons in India.
6. Do hydraulic design of different components of irrigation projects.
7. They will learn different types of water storage works.

They will also learn to calculate and design flood control devices.

10. Unit wise detailed content

1. Estimate irrigation efficiency of nearby irrigation lands.
2. Study the nearby fields for their specific crops water requirements.
3. Explore the necessity of silt ejector and extruder.
4. Examine the Requirement of fields for sub surface irrigation.
5. Explore Necessity and classification of Dams and the selection of site of Dam.
6. Study the Hydraulic design of gravity dam and prepare one gravity dam design.

1. Name of the Department: Civil Engineering Department						
2. Course Name	Advanced Geotechnical Exploration and Testing	L	T		P	
3. Course Code		3	0		0	
4. Type of Course (use tick mark)		Core ()	PE-IX(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =33		**Tutorials =0**	**Practical =0**			

8. Brief Syllabus

This course covers the advanced geotechnical exploration techniques, methods, sampling procedures and testing methods.

9. Learning objectives:

To understand the scopes and techniques involved in advanced geotechnical exploration..

10. Course Outcomes (COs):

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

1. Characterize and classify the methods of exploration
2. Understand the procedure involved in sampling
3. Uses the concept of geotechnical exploration students able to design underground structures.
4- Analysis and Design of Various Geotechnical Structures

11. Unit wise detailed content

Unit-1	**Number of lectures =10**	**Title of the unit:** Introduction to Geotechnical Exploration

Introduction: Necessity and Importance of soil exploration, Method of sub surface exploration Test pits, Trenches, Caissons, Tunnels and drifts, Wash boring, Percussion drilling , Rotary drilling, Factors affecting the selection of a suitable method of boring. Extent of boring, Factors controlling spacing and depth of bore holes, Spacing and depth of various Civil engineering structures.

Unit - 2	**Number of lectures = 10**	**Title of the unit:** Methods of exploration

Indirect method of exploration, Seismic method, Electrical resistivity, Resistivity sounding and profiling, Qualitative and quantitative interpretation of test results, Comparison of resistivity and seismic surveys, Shortcomings. Stabilization of bore holes, Different method of stabilization of the bore holes, their relative merits and demerits. Ground water Observation: Different method of ground water

observation		
Unit - 3	**Number of lectures = 12**	**Title of the unit:** Sampling Techniques
Sampling: Source of disturbance and their influence. Type of sampler, Principle of design of sampler, Representative and undisturbed sampling in various types of soils. Surface sampling, Amount of sampling, Boring and sampling record, Preservation and shipment of sample preparation of bore log.		
Unit - 4	**Number of lectures = 10**	**Title of the unit:** Testing
Penetration tests, Standard penetration tests, Dynamic cone penetration tests with and without bentonite slurry, Static cone penetration tests, factor affecting the penetration tests. Various corrections in the test results. Interpretation of test result for design and determination of modulus of deformation. Small size penetrometers. Correlation among various test results.		
12. Books Recommended (3 Text Books + 2-3 Reference Books)		
i) M. Hvorsler, Subsurface exploration and sampling of soil for Civil Engg. Purpose.		
ii) N.P. Kurien, Design of Foundation Systems : Principles & Practices, Narosa, New Delhi 1992		
iii) G.Ranjan and A S R Rao, Basic and Applied Soil Mechanics, New Age international Publishers.		
iv) B. M Das, Principles of Foundation Engineering, Thomson Brooks/Cole		
v) Simon and Cayton, Site Investigation		

1. Name of the Department: Civil Engineering Department						
2. Course Name	Advanced Geotechnical Exploration and Testing Laboratory	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	PE-IX(✔)		OE()	
5. Pre-requisite (if any)	Nil	**6.** Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem (✔)	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =33		**Tutorials =0**	**Practical =07**			

8. Brief Syllabus

This course covers the advanced geotechnical exploration techniques, methods, sampling procedures and testing methods.

9. Learning objectives:

To understand the scopes and techniques involved in advanced geotechnical exploration.

10. Course Outcomes (COs):

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

1. Characterize and classify the methods of exploration
2. Understand the procedure involved in sampling
3. Uses the concept of geotechnical exploration students able to design underground structures.
4- Analysis and Design of Various Geotechnical Structures

11. Unit wise detailed content

1- To study about sub-surface exploration tests

2- Understanding of wash boring methods

3- Field visit to understand the concept of subsurface exploration Methods

4- Different method of stabilization of the bore holes

5- Laboratory penetration test

6- Dynamic cone penetration tests

7- Determination of modulus of deformation

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Design of Steel Structures-II**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	**Design of Steel Structures-I**	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures = 342		**Tutorials =**	**Practical**			

7. Brief Syllabus:

This course contains the design of flexural members, liquid storage structures, stacks etc. This course also contains the design of different structural members made up of Light Gauge Steel and Aluminum. Along with that this course is also provided with the plastic design and design of industrial structures. This is advanced level study for the design of steel structures

8. Learning objectives:

1. Design light gauge & aluminum structures too.
2. Use relevant BIS for above structural design.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Design complicated structures like plate girder, gantry girder, Industrial structures, tanks and slabs.
2. Design steel structures on plastic theory where ever possible.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Plate Girder**

Introduction, general consideration, distribution of stresses, web panel subjected to combined bending and shear, design of plate girder using IS:800-2007, behavior of longitudinally stiffened plate, welding of girder components

Unit – 2	**Number of lectures = 10**	**Title of the unit: Industrial Structures**

Introduction, Roof and side coverings, Design loads, purlins, end bearings, general framing of industrial buildings, bracings.

Gantry Girder: Introduction, loading consideration, maximum load effect, selection of gantry girder, design of gantry girder.

Unit – 3	**Number of lectures = 10**	**Title of the unit: Steel Tanks and Stack**

Introduction, Classification of steel tank, Wind load on tank and stack, Earthquake force on tank and stack, Design of Pressed steel tank with staging, Design consideration for steel stack.

Unit – 4	Number of lectures = 12	Title of the unit :Plastic Design
Introduction, Stress strain curve, Strength of tensile and compression members, bending of rectangular section, theory of plastic bending, calculation of plastic moment, plastic hinge and mechanism, strength of redundant structures, ultimate load analysis fundamentals; Static method and Mechanism method, Distributed loading, load factor, effect of axial forces on plastic moment, lateral buckling, design of columns, design of connections.		

12. Brief Description of self-learning / E-learning component The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. Design of Steel Structures by N. Subramanian(2012), 8th Edition ,ISBN No. 978-0-19-57681-5 Oxford University Press

Referance books

1. BIS: 800-1984, B IS:800-200, BSI:1079-1973, BIS:801-1975.
2. Bowles, J.E. 1980, Structural Steel Design, McGraw Hill publication.
3. Chen W.F. and S.E. Kim1997, Steel Design Using Advanced Analysis, CRS Press

1. Name of the Department: Civil Engineering Department						
2. Course Name	Design of Steel Structures-II Laboratory	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	**Every Sem ()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures =		**Tutorials =0**	**Practical =28**			

7. Brief Syllabus:

This course contains the drawing of flexural members, liquid storage structures, stacks etc. This course also contains the drawing of different structural members made up of Light Gauge Steel and Aluminum. This is advanced level study for the drawing of steel structures.

8. Learning objectives:

1. To teach students drawing for the design of steel structures.
2. To make the students familiar with the concepts of steel drawing starting with plate girder & industrial structure based on IS:800-1984 and IS:800-2007.
3. To teach students steel stacks & plastic member drawing as a whole for uniaxial and biaxial loading along with elastic theory of buckling of beams and columns.

9.Course Outcomes (COs):

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

1. Draw various members of steel structure in Auto Cad
2. Conceptualize & imagine the drawing of various sections according to need of drawing.

10.Unit wise lab detailed content

1. Structural Drawings of various types of connections.
2. Drawing of web panel subjected to combined bending and shear
3. Drawing of girder components.
4. Roof and side coverings Drawing
5. General framing of industrial buildings Drawing
6. Drawing of different types of steel tank.
7. Plastic hinge Drawing.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Disaster reduction and management**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	**Frequency (use tick marks)**	Even ()	Odd (√)	**Frequency (use tick marks)**	Even ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

Disaster risk reduction (DRR) is a systematic approach to identifying, assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.

8. Learning objectives:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequence.
2. To increase the knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.

9. Subject Outcomes:

1. Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2.Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit:** Introduction

Earthquake resistant design of structures, Response spectra and design earthquake parameters, Principles and philosophies, Codal provisions, Factors affecting damage to structures, Enforcement of codal provisions, Strong motion instrumentation and data processing, Effective rescue operation, General planning and design aspects, Conventional earthquake resistant design,

Unit - 2	**Number of lectures = 08**	**Title of the unit:** Disaster Reduction

Seismic base isolation method, retrofitting, Training and lecturing at various levels, Preparedness to meet earthquake disaster, Programmes for public awareness, demonstrations and exhibitions, Information management (Safety, emergencies, management and planning, design, response, user experience problems and case studies), Proper land use practices, long term disaster preparedness measures

Unit - 3	Number of lectures = 12	Title of the unit: Indirect Damages
Damage due to ground failures, Landslides, rockslides, liquefaction, fire, floods, tsunamis, release of hazardous material like poisonous gas, nuclear radiation.		
Unit - 4	**Number of lectures = 12**	**Title of the unit:** Disaster Management
Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilitation (Infrasture rehabilitation, Housing rehabilitation, Social rehabilitation), Role of volunteers, Emergency operation centers, Information system, Danger zone restrictions, Cooperation with local authority		

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. Disaster Mitigation Experiences & Reflectios by Pardeep Sahni, Alka Dhameja, and Uma Medury

Reference books

Disaster Management Report by Department of Agriculture and Cooperation, Govt. of India.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Disaster reduction and management Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-XV()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 28**			

7. Learning objectives:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequence.
2. To increase the knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.

8.Course Outcomes (COs):

1. Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2.Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.

At the end of the lab course student able to

9. Subject Outcomes:

Concrete is a construction material composed of cement, fine aggregates (sand) and coarse Aggregates mixed with water which hardens with time. In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing Elements.

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Codal provisions for disaster reduction and management
2	Strong motion instrumentation and data processing
3	Study of Preparedness to meet earthquake disaster
4	Study of damage due to ground failures.
5	Study of Emergency operation centers and Information system

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Geoinformatics for Natural Disasters	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		✓ **Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	✓ Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus :- Fundamental concepts of hazards and disasters, their types, and characterization, zonation of hazards, natural and human induced disasters. Disaster and National losses, historical perspective of disasters in India.

8. Learning objectives:

The course aims at introducing various types of natural disasters and application of space inputs for disaster management and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects.

9. Course Outcomes:

On completion of this course, the student shall be able to

1) Understand the various types of disasters
2) Understand the drought and forest fire causes by using GIS.
3) Understand the various affects and measures of Earthquake, Volcanoes, Landslides and soil erosion.
4) Understand the various types of flood cyclones, and Tsunami.

1) Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit** : Introduction

Definition, types of disasters, importance of RS and GIS for disaster management, forecast, forewarning system, disaster preparedness with respect to different disaster, Spatial Data infrastructure to facilitate Disaster Management, GIS based Decision support system for disaster management, satellite surveillance for disaster mitigation.

Unit-2	**Number of lectures = 10**	**Title of the unit:** Drought and Forest Fire

Drought types, causes, mitigation measures, delineation of drought vulnerable areas, drought monitoring, GIS based drought analysis, desertification factors, monitoring vegetative biomass; Forest Fire – causes, management using GIS, risk zonation mapping, forecasting system.

Unit - 3	**Number of lectures = 11**	**Title of the unit** :- Earthquake, volcanoes, landslides and soil erosion

Causes, types, effects and mitigation measures, RS and GIS in earthquake prediction and post quake rehabilitation, GIS for earthquake disaster management, mapping tectonic lineament; Volcano: RS of geothermal field, mapping lava flows, volcano hazard management; Landslides: RS and GIS for zonation, monitoring and management; Soil erosion: RS and GIS for soil erosion and sediment estimation,

Unit - 4	**Number of lectures =11**	**Title of the unit:** Flood, Cyclone and Tsunami

Flood types- flash and riverine floods, snowmelt floods, ice jams and mud flows, causes and mitigation measures, flooding potential zonation mapping, flood hazard assessment, ice cover monitoring and its role in flooding; Cyclone: cyclone monitoring using INSAT, ERS-1, NOAA and DMSP satellites, RS and GIS in hurricane mapping and mitigation, damage assessment, warning; Tsunami: types, causes, RS and GIS for warning, damage assessment and rehabilitation

2) Brief Description of self learning / E-learning component

1. https://swayam.gov.in/course/3697-Analytical and Digital Photogrammetry

3) Books Recommended

TEXTBOOKS :

- The Environment as Hazards - Kates, B.I and G.F. White.
- Disaster Management - Singh, R.B.
- Disaster Management - Gupta, H.K.
- Space Technology for Disaster Mitigation in India - Singh, R.B.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Geoinformatics for Natural Disasters Lab	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**1. Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 20**			

8. **Brief Syllabus:** The course aims at introducing various types of natural disasters and application of space inputs for disaster management and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects

8. Learning objectives:

The course aims at introducing various types of natural disasters and application of space inputs for disaster management and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects.

9. Subject Outcomes:

On completion of this course, the student shall be able to

1) Understand the various types of disasters
2) Understand the drought and forest fire causes by using GIS.
3) Understand the various affects and measures of Earthquake, Volcanoes, Landslides and soil erosion.
4) Understand the various types of flood cyclones, and Tsunami.

10. Unit wise detailed content

Sr. No.	**Title**
1.	Study of disaster preparedness with respect to different disaster
2	Study of delineation of drought vulnerable areas.
3	Study of satellite surveillance for disaster mitigation
4	Study of RS of geothermal field, mapping lava flows
5	RS and GIS for zonation, monitoring and management
6	cyclone monitoring using INSAT, ERS-1, NOAA and DMSP satellites,

1. Name of the Department: Civil Engineering						
2. Subject Name	Design of Waste Water System	**L**	**T**		**P**	
3. Subject Code		3	0		4	
4. Type of Subject (use tick mark)		**Core ()**	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 00**			

7. Brief Syllabus:

This is a course on the fundamental wastewater systems. Different areas of waste water treatment methodologies have been incorporated to develop better understanding of the students. Also, students will learn current and emerging practices and procedures for the planning, design, and operation of wastewater facilities. Emphasis will be placed on integrating individual unit operations and processes to achieve overall treatment objectives and to satisfy given constraints.

8. Learning objectives:

1. Understand and identify the most critical issues and challenges in planning, designing, and operating wastewater treatment facilities.
2. Understand and organize all the major unit operations and unit processes associated with wastewater treatment into a complete treatment train.
3. Complete basic preliminary designs for sanitary sewer collection and influent, preliminary, primary, and secondary water and wastewater treatment unit operations and processes.
4. Analyze sanitary sewer collection and influent, preliminary, primary, and secondary water and wastewater treatment components and systems.
5. Develop design criteria necessary for the preparation of preliminary designs for water and wastewater treatment unit operations and processes.

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Apply the basics of waste water treatment methodologies
2. Understand the Design involved in the waste water treatment systems.
3. Apply the basics understanding of the parameters involved in waste water treatment systems.
4. To know the different reactors systems working currently used at municipal corporation.
5. Understand the Waste Water generation points and their characteristics, with legislation involved.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Basics of Waste Water & Designs**

Introduction: Wastewater flow and its characteristics, Wastewater collection systems, Estimation and variation of wastewater flows. Problems of industrial wastewaters, Sampling protocol, Equalization, Neutralization, Proportioning processes, Volume and strength reduction. Preliminary, primary, secondary and tertiary wastewater treatment processes. Theory and design of screens, grit chambers, sedimentation, coagulation, flocculation.

Unit - 2	Number of lectures = 12	Title of the unit: Waste Water Theory & Reactors
Physico-chemical and biological treatment strategies and their evaluation, Theory of activated sludge process (ASP), extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactor, rotating biological contactor, etc., Mass balancing in ASP and TF and their design.		
Unit - 3	**Number of lectures = 12**	**Title of the unit: Waste Water Treatment Methodology**
Anaerobic treatment process, Effects of pH, temperature and other parameters on anaerobic treatment, Concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor.		
Unit - 4	**Number of lectures = 8**	**Title of the unit: Waste Water Legislations and Generations Points**
Indian standards for disposal of treated wastewaters on land and in natural streams, Treated wastewater reclamation and reuse, Introduction to duckweed pond, vermiculture and root zone technology for wastewater treatment, Recent technologies of treatment. Study on wastewater generation points, wastewater characteristics, Treatment scheme for tannery, sugar, textile, steel, distillery, paper/ pulp and oil refinery industry wastewater. Exposure to applications based on current industrial trends.		

11. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc Graw Hill.
2. Peavy, Rowe & Tchobanoglous "Environmental Engineering", Mc. Graw Hill, New Delhi.
3. Davis, M. "Water and Wastewater Engineering'', Mc-Graw Hill.
4. Fair, G.M. & Geyer, J.C. "Water supply and Wastewater Disposal", John Wiley & Sons.
5. Qasim, S.R., Motley, E.M., and Zhu, G. "Water Works Engineering", Prentice Hall Publication.

1. Name of the Department: Civil Engineering						
2. Course Name	Design of waste Water System Lab	L	T		P	
3. Course Code		0	0		2	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward waste water system. In addition to that, this course will inculcate the understanding about parameters involved in the determination of water quality.

8. Learning objectives:

1. Understand the analytical processes for determination of waste water variables.
2. To gain insight into basic concept of waste water properties.
3. Understand the parameter involved in determination of waste water quality.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of variables of waste water.
2. Apply the understanding of analytical techniques toward parameters that control the water quality.

8. Unit wise detailed content

1. To determine the pH of a sample.
2. To estimate the Total Suspended and Volatile Suspended Solids.
3. To estimate the Total and Volatile Sludge Solids.
4. To determine the Total Dissolved Solids.
5. To determine the Dissolved Oxygen by Winkler Titration Method.
6. Determination of Iron and Manganese in Water
7. Determination of Sulphate and Sulphide in Water
8. Jar Test for Determining Optimum Coagulant Dosage
9. Determination of Available Chlorine in Bleaching Powder
10. Test for Residual Chlorine

Departmental Electives X

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Environmental Hydraulics**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical						
Lectures =42		**Tutorials = 00**	**Practical = 00**			

7. Learning objectives:

1. Understand and solve problems in uniform, gradually and rapidly varied flows in open channel in steady state conditions
2. Get the knowledge on different hydraulic machinery devices and its principles that will be utilized in hydropower development and for other practical usages

9. Subject Outcomes:

On completion of this course, the students will be able to

1. Apply their knowledge of fluid mechanics in addressing problems in open channels and hydraulic machinery.
2. Apply dimensional analysis and to differentiate the model, prototype and similitude conditions for practical problems.

9. Unit wise detailed content

Unit-1	**Number of lectures = 09**	**Title of the unit:** Laminar and Turbulent Flow

Laminar flow through: circular pipes, annulus and parallel plates. Stoke‟s law, Measurement of viscosity.

Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semiempirical theories of turbulence, Prandtl‟s mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody‟s diagram.

Unit – 2	**Number of lectures = 08**	**Title of the unit:** Boundary Layer Analysis-

Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Unit – 3	**Number of lectures = 08**	**Title of the unit:** Dimensional Analysis and Hydraulic Similitude

Dimensional homogeneity, Rayleigh method, Buckingham‟s Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional

analysis and model studies to fluid flow problem.

Unit – 4	Number of lectures = 08	Title of the unit: Hydraulic Jump-

Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types ,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow-Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation.

10. Brief Description of self learning / E-learning component

The students will be encouraged to learn using the SGT e-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

The link to the E-Learning portal.

https://elearning.sgtuniversity.ac.in/course-category/Journal papers; Patents in the respective field.

11. Books Recommended

Text Books

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House.

<table>
<tr><td colspan="8">1. Name of the Department: Civil Engineering Department</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Environmental Hydraulics Laboratory</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>0</td><td colspan="2">0</td><td colspan="2">4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE(√)</td><td colspan="2">OE()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>Odd ()</td><td>Either Sem ()</td><td>Odd (√)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 28</td><td>Tutorials =0</td><td colspan="4">Practical =0</td></tr>
<tr><td colspan="8">7. Learning objectives:
1. Understand and solve problems in uniform, gradually and rapidly varied flows in open channel in steady state conditions
2. Get the knowledge on different hydraulic machinery devices and its principles that will be utilized in hydropower development and for other practical usages</td></tr>
<tr><td colspan="8">8. Subject Outcomes: On completion of this course, the students will be able to
1. Apply their knowledge of fluid mechanics in addressing problems in open channels and hydraulic machinery.
2. Apply dimensional analysis and to differentiate the model, prototype and similitude conditions for practical problems.</td></tr>
<tr><td colspan="8">9. Unit wise detailed content</td></tr>
<tr><td colspan="8">1. To verify Stoke’s Law.
2. Calculate the Reynolds number of flow.
3. Determine turbulence in pipe flow.
4. Study and determine the boundary layer thickness of fluid flow.
5. Calculate the hydraulic jump causes and it’s position.
6. Study the behaviour of positive and negative surge in a flume flow.</td></tr>
</table>

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Earthquake Engineering	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
6 .Total Number of Lectures, Tutorials, Practical						
Lectures = 33		**Tutorials =**	**Practical**			

7.Brief Syllabus:

Earthquakes performance of structures in past earthquakes. Philosophy of earthquake resistant design and concept of ductility, Short and long period structures, Concept of spectrum, Static force calculations. Effect of soils and liquefaction, Remedial measures, Construction of earth structures.

8. Learning objectives:

1. The students will get a diverse knowledge of earthquake engineering practices applied to real life problems
2. The students will learn to understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspects.

9. Subject Outcomes:

1. Students will be able to Understand the causes, nature, effect , consequences and effects of an earthquake on buildings and about the various seismic zones of India and about past Indian Earthquakes.
2. Students will be able explain importance of structural dynamics and earthquake exactions in civil engineering in practice
3.Students will be able to understand the concept of building earthquake resistant using base Isolation and seismic dampers.

10. Unit wise detailed content

Unit-1	**Number of lectures = 07**	**Title of the unit: Introduction**

Causes of Earthquakes, Basic Terminologies, Magnitude & Intensity and elastic rebound theory, Theory of plate tectonics and movement of Indian plate. Seismic waves, Seismic intensity, Richter scale, Tsunami. Seismic zoning maps of India and comparison study, Response spectra.

Unit - 2	**Number of lectures = 09**	**Title of the unit: Earthquake effects on the structures**

Classification of loads, Seismic methods of Analysis, Seismic design methods,. Seismic

damages during past earthquakes and effects of irregularities and building architecture on the performance of RC structures.

Unit - 3	Number of lectures = 08	Title of the unit: Theory of vibration

Introduction to theory of Vibration, Sources of Vibrations, Types of Vibrations. Lateral load analysis and design of two- storied masonry buildings. Ductility Requirements, types of ductility, factors affecting ductility. IS code provisions.

Unit - 4	Number of lectures = 09	Title of the unit: Seismic retrofitting

Sources of weakness in RC framed buildings, Classification of retrofitting techniques, Conventional and non-conventional methods, Comparative study of various methods and case studies, failure modes of masonry structures and repairing techniques.

11. Books Recommended

Text Books

P. Agarwal and M. Shrikhande - Earthquake Resistant Design of Structures, Prentice Hall Publications

2.IS:1893- Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.

References

1.IS:3935-Repair and Seismic Strengthening of Buildings-Guidelines,1993

2.IS:4326-Earthquake Resistance Design and Construction of Buildings — Code of Practice, 1993

3.IS:13828— Improving Earthquake Resistance of Low Strength MasonryBu

<table>
<tr><td colspan="8">1. Name of the Department: Civil Engineering Department</td></tr>
<tr><td colspan="2">2. Course Name</td><td>Earthquake Engineering Lab</td><td>L</td><td colspan="2">T</td><td colspan="2">P</td></tr>
<tr><td colspan="2">3. Course Code</td><td></td><td>0</td><td colspan="2">0</td><td colspan="2">4</td></tr>
<tr><td colspan="3">4. Type of Course (use tick mark)</td><td>Core ()</td><td colspan="2">PE(√)</td><td colspan="2">OE()</td></tr>
<tr><td colspan="2">5. Pre-requisite (if any)</td><td></td><td>Odd ()</td><td>Either Sem ()</td><td>Odd (√)</td><td>Either Sem ()</td><td>Every Sem ()</td></tr>
<tr><td colspan="8">6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)</td></tr>
<tr><td colspan="3">Lectures = 28</td><td>Tutorials =0</td><td colspan="4">Practical =0</td></tr>
<tr><td colspan="8">7. Learning objectives:
The students will get a diverse knowledge of earthquake engineering practices applied to real life problems
The students will learn to understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspects.</td></tr>
<tr><td colspan="8">8. Subject Outcomes: On completion of this course, the students will be able to
1. Students will be able to Understand the causes, nature, effect , consequences and effects of an earthquake on buildings and about the various seismic zones of India and about past Indian Earthquakes.
2. Students will be able explain importance of structural dynamics and earthquake exactions in Civil engineering in practice.</td></tr>
<tr><td colspan="8">9. Unit wise detailed content</td></tr>
<tr><td colspan="8">1. Study of plate tectonics and movement.
2. Seismic zoning maps of India and comparison study
3. Seismic methods of Analysis.
4. Seismic damages during past earthquakes.
5. . Lateral load analysis
6. Study of IS code provisions.
7. Failure modes of masonry structures and repairing techniques
8. Comparative study of various methods</td></tr>
</table>

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Maintenance of Building Structure**	**L**	**T**		**P**	
3. Subject Code		3	0		0	
4. Type of Subject (use tick mark)		**Core ()**	**PE(√)**		**OE()**	
5. Pre-requisite (if any)	**Frequency (use tick marks)**	Even ()	Odd (√)	**Frequency (use tick marks)**	Even ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical =00**			

7. Brief Syllabus:

Disaster risk reduction (DRR) is a systematic approach to identifying, assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.

8. Learning objectives:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequence.
2. To increase the knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.

9. Subject Outcomes:

1. Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2.Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.

10. Unit wise detailed content

Unit-1	**Number of lectures = 09**	**Title of the unit:** Acoustics

Basic problems criteria and terminology, Transmission of sources in rooms, speech privacy between offices, co-efficient of source absorption, noise reduction co-efficient, classification selection of accoustical materials, design and installation of accoustical Treatment for of auditorium, schools religtion buildings.

Unit - 2	**Number of lectures = 08**	**Title of the unit:** Air Conditioning Heating and Ventilation

Different types of heating equipment viz radiation converters, electric radiant panel heaters, requirements comfort conditions, temperature control, humidity control Mechanical ventilation plenum system, exhaust system fans, airfilters of different types, air conditioning plants layout of ducts for cinema auditoriums and offices etc

Unit - 3	**Number of lectures = 08**	**Title of the unit:** Fire Fighting

Fire regultions and requirements, cause of fire, fire resistance of materials, fire tests, firerestance of elements, layout excape means for Multi storeyed buildings, Fire Training equipment different methods of fire fighting fire protection.

Unit - 4	Number of lectures = 08	Title of the unit: Electrical Services

General distribution of electric power : Sub-stations for small schemes and industrial units, meter-roms, electrical instllations in buildings, Fuses and Circuit breakers, various types of conduits, earthing, switches and outlet, lamp holder electrical wiring -different materials employed specifications, electrical appliances and electrical service bye-laws pertianing to electrical installations. Different types of artificial lighting systems, lighting systems for residential buildings, public buildings, hotels, cinemas, hospitale exhibition, halls, libraries, schools, college, scientific laboratories etc.

11. Brief Description of self-learning / E-learning component

The students will be encouraged to learn using the SGT E-Learning portal and choose the relevant lectures delivered by subject experts of SGT University.

12. Books Recommended

Text Books

1. IVOR H. Seeley, Building Technology Mac Millian..

Referance books

1. Building Construction materials and types of construction WHITNEY CLARK HUNTINGTON PROBERT E. MICKADEIT Allan Hancock College.
2. Lee Smith, Harry Slecter, Plumbing Technology, Design and installation Delmar Publisher INC.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	**Maintenance of Building Structure Lab**	**L**	**T**		**P**	
3. Subject Code		0	0		4	
4. Type of Subject		Core ()	PE-XV()		OE()	
5. Pre-requisite (if any)	Nil	Frequency (use tick marks)	Even ()	Odd (✔)	Either Sem ()	Every Sem ()

6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)		
Lectures = 00	**Tutorials = 00**	**Practical = 28**

7. Learning objectives:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequence.
2. To increase the knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.

8.Course Outcomes (COs):

1. Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2.Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.

At the end of the lab course student able to

9. Unit wise detailed content

10. Tutorial / Extended Tutorial /Case study components/laboratory

Sr. No	**Title**
1	Study of Transmission of sources in rooms
2	Design and installation of acoustical Treatment for of auditorium, schools religion buildings
3	Air conditioning plants layout of ducts for cinema auditoriums and offices.
4	layout escape means for Multi storeyed buildings
5	Study of electrical appliances and electrical service bye-laws pertaining to electrical installations

1. Name of the Department		**CIVIL ENGINEERING**				
2. Course Name	Geoinformatics for Land use Surveys	**L**	**T**		**P**	
3. Course Code		3	0		0	
4. Type of Course		✓ **Core ()**	**PE()**		**OE()**	
5. Pre-requisite (if any)		**6. Frequency (use tick marks)**	Even ()	✓ Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practical(assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 00**	**Practical = 00**			

Brief Syllabus: - To develop the skills in utilization of technologies of remote sensing, GIS, GPS, etc. in Land Resource Analysis and planning for sustainable development, soil, forest, ecology and agricultural resources management and studies.

8. Learning objectives:

The course aims at introducing various types of natural disasters and application of space inputs for land use surveys and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects.

9. Course Outcomes:

On completion of this course, the student shall be able to

1) Understand the various geological and geo-technical studies
2) Understand the applications of soil.
3) Understand the various mapping and monitoring estimation for forest and ecology.
4) Understand the various applications of Geoinformatics in agriculture.

4) Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit** : Geological and Geo-technical studies:

Mineral resources exploration, mineral mapping and mineral resources information system, mapping mining area, encroachment mapping, GIS in mine remediation and mine reclamation, oil and gas exploration, site suitability for dams, atomic power plants.

Unit-2	**Number of lectures = 10**	**Title of the unit:** Applications in soil

Soil and Land Use Surveys, Soil classification, soil irritability, soil erosion mapping, soil salinity, soil alkalinity, surface soil moisture estimation, runoff and sediment yield estimation, desertification mapping, soil fertility mapping, agro-land suitability assessment, soil capability and loss assessment, location and climatic advantages, settlements and demographic pressure estimation.

Unit - 3	**Number of lectures = 11**	**Title of the unit** :- Forest and Ecology

RS and GIS for forest cover mapping and monitoring, estimation of biomass, carbon sequestration,

Wildlife ecology: wildlife tracking, protected areas, wildlife habitat selection, rangeland applications, forest fire surveillance and forecasting, forest burnt area mapping, fire spread modeling, revegetation, biodiversity characterization, deforestation/ afforestation/encroachment mapping and monitoring, impact assessment of mining in forest.

Unit - 4	**Number of lectures =11**	**Title of the unit:** Application in agriculture

Agro-climatic zonation, site suitability for agricultural and horticulture crops, crop acreage estimation, RS based yield model, crop norm violation, RS basis for crop insurance claim, damage assessment due to cyclone, drought, flood and forewarning, crop stress detection, precision agriculture.

5) Brief Description of self learning / E-learning component

1. https://swayam.gov.in/course/3697-Analytical and Digital Photogrammetry

6) Books Recommended

TEXTBOOKS :

- Introduction to Environmental Remote Sensing – Barrett E. C.
- Remote Sensing Principles and Interpretations – Sabins F. F.
- Remote Sensing and Image Interpretation – Thomas M. Lillesand
- Modeling in Resource Management and Environment - Sharma H.S. and Binda P.R.

1. Name of the Department		**CIVIL ENGINEERING**				
2. Subject Name	Geoinformatics for Land use Surveys Lab	**L**	**T**		**P**	
3. Subject Code		0	0		2	
4. Type of Subject (use tick mark)		**Core (√)**	**PE()**		**OE()**	
5. Pre-requisite (if any)	Nil	**2. Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 00		**Tutorials = 00**	**Practical = 20**			

7. Brief Syllabus: To develop the skills in utilization of technologies of remote sensing, GIS, GPS, etc. in Land Resource Analysis and planning for sustainable development, soil, forest, ecology and agricultural resources management and studies.

8. Learning objectives:

The course aims at introducing various types of natural disasters and application of space inputs for land use surveys and GIS techniques used for mapping, impact assessment, forewarning, preparedness and mitigation of adverse effects.

9. Subject Outcomes:

On completion of this course, the student shall be able to

1) Understand the various geological and geo-technical studies
2) Understand the applications of soil.
3) Understand the various mapping and monitoring estimation for forest and ecology.
4) Understand the various applications of Geoinformatics in agriculture.
5)

10. Unit wise detailed content

Sr. No.	**Title**
1.	Study of GIS in mine remediation and mine reclamation
2	Study of runoff and sediment yield estimation.
3	Study of settlements and demographic pressure estimation.
4	Study of RS and GIS for forest cover mapping and monitoring
5	Forest fire surveillance and forecasting, forest burnt area mapping, fire spread modeling, revegetation,
6	Site suitability for agricultural and horticulture crops

1. Name of the Department: Civil Engineering						
2. Subject Name	Water Quality Modeling	**L**	**T**		**P**	
3. Subject Code		3	0		4	
4. Type of Subject (use tick mark)		**Core ()**	**PE (√)**		**OE ()**	
5. Pre-requisite (if any)	Nil	**Frequency (use tick marks)**	Even (√)	Odd ()	Either Sem ()	Every Sem ()
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 42		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This course will discuss a wide variety of waters and factors and processes affecting the microbial water quality. We will also discuss the approaches that may be taken to improve the quality of water. At the end of this course, students will learn how intentional, incidental or unintentional misuse of water resources can have a detrimental consequence on human health. The course will also cover water remediation and safeguard techniques for the improvement of water quality.

8. Learning objectives:

1. Sources of microbial water contamination and its impact of human health globally.
2. Understand the relationship between human behavior and water quality.
3. Develop remediation strategies for several types of microbial water quality contamination.
4. Understand epidemiological studies related to water quality and public health.
5. Understand various water sources and transmission mechanisms of infectious agents.

9. Course Outcomes:

On completion of this course, the students will be able to

1. Apply the basics of water quality in day-to-day life.
2. Understand the significance of Management practices for maintaining water quality.
3. Apply the understanding of water treatment methods in water conservation.
4. Apply the skills in developing proper waste disposal for water quality maintenance.
5. Apply the dynamics of water in conservation strategies.

10. Unit wise detailed content

Unit-1	**Number of lectures = 10**	**Title of the unit: Overview of Water Quality**

Water quality: sources and impacts of impurities, classification of water quality parameter Standards: drinking water quality standards, effluent disposal standards, Surface water, pollution: sources, Effects of Surface water pollution: physico-chemical, biological, toxic and pathological, Ground water pollution: sources & effects, Consequences of overusing of surface water & ground water.

Unit - 2	**Number of lectures = 12**	**Title of the unit: Water Management Practices**

Non-point source pollution-Agricultural runoff, TMDLs, Best management practices (BMPs), Numeric vs narrative standards, Water quality dynamics and human impacts on water quality. Human population growth-Modern lifestyle effects on the water and human health.

Unit - 3	Number of lectures = 12	Title of the unit: Water Treatment Methods
Water treatment in developed and developing countries -Primary, secondary, and tertiary treatments, Land application of sewage, Improving the quality of drinking water at the source: Education and proper hygiene, Proper waste disposal, Water chlorination, Improving surveillance.		
Unit - 4	**Number of lectures = 8**	**Title of the unit: Dynamics of Water Quality**
Water quality and health linkage; Understanding the significance of the environment for human health, Human population pressures and pollution dynamics, Common terms and definitions in water quality, Aquatic resources of the world & Sources of drinking water, Common contaminants of drinking, water and linkages to disease. Exposure to applications based on current industrial trends.		

11. Books Recommended (3 Text Books + 2-3 Reference Books)

1. Hall, W.A. and Dracup, J.A., Water resources systems engineering, Mc Graw Hill, 1970.

2. Hexem, R.W. and Heady E.O., Water production functions for irrigated agriculture, Iowa State University Press, 1978.

3. James, L.D. & Robert, R. L., Economics of Water Resources Planning, 1970, 5th edition.

4. Lee, S.M., Linear optimization for management, Petrocelli/ Charter, New York, 1976. Isobel W Heathcote. 1998. Integrated Watershed Management: Principles and Practice. Wiley Publ.

5. Kenneth N Brooks, Peter F Folliott, Hans M Gregersen, Leonard F DeBano. 1991. Hydrology and the Management of Watersheds. Wiley-Blackwell.

1. Name of the Department: Civil Engineering						
2. Course Name	Water Quality Modeling Lab	L	T		P	
3. Course Code		0	0		4	
4. Type of Course (use tick mark)		Core ()	**PE(√)**		**OE()**	
5. Pre-requisite (if any)		Odd ()	Either Sem ()	Odd (√)	Either Sem ()	Every Sem **()**
6. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester)						
Lectures = 0		**Tutorials = 0**	**Practical = 28**			

7. Brief Syllabus:

This laboratory course work emphasis on development of basic knowledge of the learner toward water system. In addition to that, this course will inculcate the understanding about parameters involved in the water modeling.

8. Learning objectives:

1. Understand the processes for determination of water modeling.
2. To gain insight into basic concept of water modeling.
3. Understand the parameter involved in determination of water modeling variables.

7. Course Outcomes (COs):

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

1. Apply the methodologies involved in the determination of water modeling.
2. Apply the understanding of analytical techniques toward parameters that influences water modeling.

8. Unit wise detailed content

1. Determination of Optimum Coagulant dosage
2. Determination of residual chlorine in bleaching powder
3. Determination of available chlorine in bleaching powder
4. Determination of Oil and Grease
5. Determination of suspended, settleable, volatile and fixed solids.
6. Determination of pH, Turbidity and conductivity
7. Determination of Hardness
8. Determination of Alkalinity and Acidity
9. Determination of Chlorides
10. Determination of Phosphates and Sulphates