Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**Civil Engineering and Mechanics**						
Course Code	**21CVT104 / 204**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**39**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	Students will be exposed to apply the knowledge of the principles of mechanics in various fields of Engineering curricula and develop analytical ability and powers of reasoning.
2	To become conversant with basic concepts of equilibrium with reference to support reactions and friction.
3	To understand the significance of centroid and moment of inertia and to determine the coordinates of the centroid and moment of inertia of the composite sections.
4	To familiarize with laws of motion, kinematics of motion and their inter relationships.

Unit No.	Syllabus	No. of hours
I	**Basics of Civil Engineering** **Introduction to Civil Engineering:** Scope of different fields of Civil Engineering – Surveying, Building materials, Construction technology, Geotechnical engineering, Structural engineering, Water resource engineering and Irrigation engineering, Transportation engineering, Environmental engineering. **Infrastructure:** Types of infrastructure, role of civil engineer in the infrastructure development, Effect of the infrastructure facilities on socio-economic development of a country. **Roads:** Types of roads, components and their function. **Bridges and Dams:** Different types with simple sketches. **Self-study:** Case study of infrastructural development of a region, types of roads, bridges and dams.	**07**
II	**Fundamental principles of mechanics:** Introduction, basic principles and concepts of mechanics, laws of mechanics, idealization of mechanics **Basic principles of statics:** Force and its characteristics, equivalent system of forces, principles of transmissibility of a force, systems of forces, resultant of coplanar concurrent forces, component of a force, moment of a force with respect to a point, principles of moments (Varignon's theorem), Couples, effects of a force at another point, equations of static equilibrium, free body diagram. **Co-planar forces (forces in a plane):** Resultant of co-planar concurrent forces, equilibrium of co-planar concurrent forces and Numerical problems. **Co-planar non concurrent force system:** Resultant of co-planar non-concurrent forces, equilibrium of coplanar non concurrent forces and Numerical problems.	**10**
III	**Support Reactions:** Introduction, Beam, Classification of beams, types of loads and supports, support reactions in statically determinate beams - Numerical problems. **Friction:** Introduction, laws of dry friction, limiting friction, co-efficient of friction, angle of friction, angle of repose and cone of friction. Numerical problems on Blocks (horizontal and inclined plane), Ladder friction and Wedge friction.	**07**

IV	**Centroid:** Introduction, centroid and centre of gravity. Derivations of simple geometrical sections – rectangle, triangle, semicircle and quarter circle. Numerical problems on composite sections. **Moment of Inertia:** Introduction, Moments of Inertia of an area, Parallel axis theorem, Perpendicular axis theorem, Radius of gyration, Polar moments of inertia. Derivations of simple geometrical sections – Rectangle, Triangle, Circle, Semicircle and Quarter circle. Numerical problems on composite sections.	**08**
V	**Basic Principles of Dynamics:** Introduction, kinematics and kinetics, Definitions of Displacement, Speed, Velocity and Acceleration. D' Alembert's principle with Numerical problems. Newton's Laws of motion. Rectilinear motion with simple-numerical problems Differential relationship between displacement, velocity and accelerations. Projectile with numerical problems.	**07**

Course Outcomes: The students will be able to	
1	Discuss the basics of Civil Engineering, Concept of Engineering Mechanics, Forces and Force Systems to determine the resultant.
2	Define the effect of forces on the bodies in respect of its contact surfaces and the reactions developed in the system.
3	Identify the geometrical properties like, coordinates of the centroid and Moment of Inertia of regular, irregular and built-up sections.
4	Illustrate the kinetics, kinematics and rectilinear motion of a body with numerical approach.

Suggested Text Book(s):	
1	Irving H Shames, Engineering Mechanics, Prentice Hall.
2	F P Beer and E R Johnson, Vector Mechanics for Engineers, Vol-II-Dynamics, Tata McGraw Hill.
3	Engineering Mechanics by Timoshenko-Young and J V Rao, Mc Graw-Hills Book Company, New Delhi.
4	Elements of Civil Engineering (IV Edition) by S S Bhavikatti, Vikas Publishing House Pvt. Ltd. New Delhi.
5	Elements of Civil Engineering and Engineering Mechanics, by M N Shesha Prakash and G V Mogaveer, PHI Learning 2014.

Suggested Reference Book(s):	
1	R C Hibler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
2	Endy Ruina and Rudraprathap, Introduction to Statics and Dynamics, Oxford University Press.
3	Shanes and Rao, Engineering Mechanics, Pearson Education.
4	Bansal R J, Text Book of Engineering Mechanics, Likshmi Publications.
5	Engineering Mechanics by M V S Rao and D R Durgaiah, University Press 2005.

Other useful e-resources:
https://www.youtube.com/watch?v=nGfVTNfNwnk&list=PLOSWwFV98rfKXq2KBphJz95rao7q8 PpwT https://www.youtube.com/watch?v=nkg7VNW9UCc&list=PLOSWwFV98rfKXq2KBphJz95rao7q8P pwT&index=2 https://www.youtube.com/watch?v=ljDIIMvxeg&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=5 https://www.youtube.com/watch?v=VQRcChR9IkU&list=PLOSWwFV98rfKXq2KBphJz95rao7q8Pp wT&index=18 https://www.youtube.com/watch?v=3YBXteL-qY4 https://www.youtube.com/watch?v=z95UW4wwzSc&list=PLOSWwFV98rfKXq2KBphJz95rao7q8P pwT&index=10 https://www.youtube.com/watch?v=lheoBL2QaqU&list=PLOSWwFV98rfKXq2KBphJz95rao7q8Pp wT&index=7 https://www.youtube.com/watch?v=atoP5_DeTPE https://www.youtube.com/watch?v=ksmsp9OzAsI https://www.youtube.com/watch?v=x1ef048b3CE

https://www.youtube.com/watch?v=l_Nck-X49qc
https://play.google.com/store/apps/details?id=appinventor.ai_jgarc322.Resultant_Force
https://www.youtube.com/watch?v=RIBeeW1DSZg
https://www.youtube.com/watch?v=R8wKV0UQtlo
https://www.youtube.com/watch?v=0RZHHgL8m_A
https://www.youtube.com/watch?v=Bls5KnQOWkY 4 JBOS 18.10.2021 / EC 30.10.2021 Activity-

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:

https://www.youtube.com/watch?v=Zrc_gB1YYS0
https://play.google.com/store/apps/details?id=vn.edu.best4u.com.bieudonoiluc
https://www.youtube.com/watch?v=Hn_iozUo9m4
https://play.google.com/store/apps/details?id=com.teobou
https://www.youtube.com/watch?v=WOHRp3V-QA0

Theory Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO & PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓										✓
CO3	✓	✓										✓
CO4	✓	✓		✓								✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**Rural Development Engineering**						
Course Code	**21CVT109 / 209**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**13**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 02 Hours**		

Course Objectives:	
1	Describe the scope of Rural Development Planning and Concept of Appropriate Technology and implementation of various national policies.
2	Understand the need and concept of low-cost construction materials for individual and group housing;
3	Illustrate the concept of Water Supply and Rural Sanitation.
4	Interpret the concept of rural transport system and issues related to it.
5	Summarize the need of effective Watershed and catchments area development methods and problems relating to watershed management, watershed structures

Unit No.	Syllabus	No. of hours
I	**Rural Development Planning and Concept of Appropriate Technology**: Scope; development plans; various approaches to rural development planning; concept of appropriate technology. Rural development program / projects.	**03**
II	**Rural Housing:** Low-cost construction materials for housing; Composite material - ferro-cement & fly ash, soil-stabilized un-burnt brick; Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry; rat-trap bond for walls; Panels for roof, ferro-cement flooring / roofing units.	**03**
III	**Rural Water Supply and Sanitation:** Sources of water. BIS and WHO water standards. Quality, Storage and distribution for rural water supply works; low-cost water treatment technologies; conservation of water; rainwater harvesting; drainage in rural areas, septic tank; low-cost community & individual Garbage disposal systems	**03**
IV	**Rural Transportation System:** Categories of Pavement Layers, Types of roads, Surface Treatments for roads in rural areas. Soil Stabilization, Lime, Lime Fly ash and Cement Treated Course.	**03**
V	**Irrigation Techniques:** Consideration of low-cost irrigation techniques, drip & sprinkler irrigation systems. Watershed and catchments area development - problems and features of watershed management, watershed structures	**03**

Course Outcomes: The students will be able to	
1	Describe the scope of Rural Development Planning and Concept of Appropriate Technology and implementation of various national policies.
2	Understand the need and concept of low-cost construction materials for individual and group housing.
3	Illustrate the concept of Water Supply and Rural Sanitation.
4	Interpret the concept of rural transport system and issues related to it.
5	Summarize the need of effective Watershed and catchments area development methods and problems relating to watershed management, watershed structures

Suggested Text Book(s):	
1	Rural Development by Katar Singh, SAGE Publication
2	A.G.Madhov Rao, D.S.Ramachandra Murthy, Appropriate Technologies for low cost Housing Oxford and IBH Publishing Co. Pvt .Ltd.

Suggested Reference Book(s):	
1	Rural Infrastructure by P.Nair, SBS Publication
2	Rural Infrastructure by Samalia Bihari Verma, Gyaneshwar Prasad & Sahib Kumari Singh, Sarup & Sons.
3	C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures. Wiley Eastern Ltd.,
4	Document on Rural Road Development in India Volume1& 2; Central Road Research Institute, New Delhi.

Other useful e-resources:
https://www.youtube.com/watch?v=8N7ckN-O3yA https://www.youtube.com/watch?v=LXgyAfnBgWo https://www.youtube.com/watch?v=1Q188bq6U8Y https://www.youtube.com/watch?v=Y3giIjR6qTM https://www.youtube.com/watch?v=rfRVX9DdNVA https://www.youtube.com/watch?v=yO-AYyPa_Rk

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
https://www.youtube.com/watch?v=IdBemHBN7xQ https://www.youtube.com/watch?v=rsg_GXldFmQ

Theory Question paper pattern:
• The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. The students will have to answer five full questions, selecting one full question from each unit.

CO & PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓	✓					
CO2							✓					
CO3			✓				✓					✓
CO4							✓					
CO5					✓		✓					✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**STRENGTH OF MATERIALS**						
Course Code	**21CVT302**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**2**	**0**	**5**	**50**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	Understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2	Interpret different internal forces and stresses induced due to representative loads on structural elements.
3	Determine slope and deflections of beams.
4	Evaluate the behavior of torsion members, columns and struts.

Unit No.	Syllabus	No. of hours
I	**SIMPLE STRESS AND STRAIN:** Introduction, Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain Diagram for structural steel and non-ferrous materials, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections.	**08**
II	**SIMPLE STRESS AND STRAIN (CONTINUED):** Elongation member due to self– weight, Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants, Thermal stresses (including thermal stresses in compound bars).	**08**
III	**BENDING MOMENT AND SHEAR FORCE IN BEAMS:** Introduction, Types of beams loadings and supports, Shearing force in beam, Bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL and Couple, Point of contra-flexure.	**08**
IV	**BENDING STRESS AND SHEAR STRESS IN BEAMS:** Introduction – Bending stress in beam, Assumptions in simple bending theory, Pure bending derivation of Bernoulli's equation, Modulus of rupture, section modulus, Flexural rigidity, Expression for shear stress in beam, Shear stress diagram for rectangular, symmetrical 'I' and 'T' section (Flitched beams not included). **DEFLECTION OF BEAMS:**	**08**

	Introduction – Definitions of slope, deflection, Elastic curve-derivation of differential equation of flexure, Sign convention, Slope and deflection for standard loading classes using Macaulay's method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.	
V	**TORSION OF CIRCULAR SHAFTS:** Introduction – Pure torsion-Torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections. **ELASTIC STABILITY OF COLUMNS:** Introduction – Short and long columns, Euler's theory on columns, Effective length slenderness ration, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula and problems.	**08**

Expt. No	**LABORATORY EXPERIMENTS:**	**No. of sessions**
1	Shear Test on Mild steel.	**10**
2	Impact test on Mild Steel (Charpy and Izod).	
3	Hardness tests on ferrous and non-ferrous metals – Brinell's method	
4	Hardness tests on ferrous and non-ferrous metals – Rockwell method	
5	Hardness tests on ferrous and non-ferrous metals – Vicker's method	
6	Tension test on Mild steel and HYSD bars.	
7	Compression test of Mild Steel and Cast iron.	
8	Torsion test on Mild Steel circular sections.	
9	Bending Test on Wood Under two point loading.	
10	Test on helical spring - compression (Demo)	

Course Outcomes: At the end of the course the student will be able to:	
1	Understand the basic principles of internal stress distribution, deflection and their causes in beams.
2	Study the behaviour of beams and columns under different loading conditions.
3	Solve the problems under various loadings and boundary conditions on beams and columns.

Teaching Learning Process: These are sample Strategies, which the teacher can use to accelerate the attainment of the various course outcomes.	
1	Power point Presentation, Video.
2	Video tube, NPTEL materials.
3	Quiz/Assignments/Open book test to develop skills.
4	Adopt problem based learning (PBL) to develop analytical and thinking skills.
5	Encourage collaborative learning in the class with site visits related to the subject and impart practical knowledge.

Text Book(s):	
1	Strength of Materials, R K Bansal, Lakshmi Publications (P) Ltd., 6th Edition.
2	Strength of Materials, S Ramamrutham, Dhanpath Rai, Publishing Co, 20th Edition.
3	Strength of Materials, Bhavikatti S S, Vikas Publishing house (P) Ltd, 5th Edition

Reference Book(s):	
1	Elements of Strength of Materials, Timoshenko and Young Affiliated East-West Press, 3rd Edition.
2	Strength of Materials, R Subramanyam, Oxford University Press, 3rd Edition.
3	Strength of Materials, B C Punmia, Ashok Jain, Arun Jain, Lakshmi Publications (P) Ltd, 10th Edition.

Web links and Resources:	
1	Strength of Materials web course by IIT Roorkee https://nptel.ac.in/courses/112107146/
2	Strength of Materials video course by IIT Kharagpur https://nptel.ac.in/courses/105105108/
3	Strength of Materials video course by IIT Roorkee https://nptel.ac.in/courses/112107147/18

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
Seminars / Quiz (to assist in GATE preparations). Demonstrations in the lab. Self-Study on simple topics. Virtual lab experiments.

Process of Ascertaining (both CIE and SEE):
50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together. **Continuous Internal Evaluation (CIE):** Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester. First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester. The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason. Two assignments each of **05 Marks (taken average at the end)** First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester. Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**) CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the COs and POs and PSOs. At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.

(For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							✓
CO2	✓	✓			✓							✓
CO3	✓		✓				✓			✓		✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**SURVEYING**						
Course Code	**21CVT303**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**2**	**0**	**5**	**50**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	Provide basic knowledge about principles of surveying for location, design and construction of civil engineering projects
2	Develop skills for using surveying instruments including, levelling instruments, plane tables, theodolite, compass
3	To familiarize in acquiring surveying data and applying fundamental concepts to eliminate errors and set out the works
4	Expose to new technologies which are used for abstracting the information of earth Surface

Unit No.	Syllabus	No. of Hours
I	**Introduction to Surveying:** Importance of surveying in Civil Engineering, Concepts of plane and geodetic surveying Principles of surveying –Plans and maps – Surveying equipment, Meridians, Bearings, Dip, Declination, Local attraction, Calculation of bearings and included angles.	**07**
II	**Compass surveying:** Introduction**,** Prismatic and surveyor's compasses, temporary adjustments. **Areas and volumes:** Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpsons one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes-trapezoidal and Prismoidal formula	**07**
III	**Levelling:** Principles and basic definitions, Types of Levels, Types of adjustments and objectives, Types of levelling, Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning, Booking of levels – Rise & fall and H. I methods **Contouring:** Contours and their characteristics, Methods of contouring, direct and indirect methods, Interpolation techniques, Uses of contours.	**08**
IV	**Curve Surveying:** Curves – Necessity – Types, Simple curves, Elements, Designation of curves, setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankine's deflection angle method (numerical	**09**

	problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius).	
V	**Total Station Survey:** Concept of latitude & departure, calculation of latitude-longitude of a closed traverse (simple analytical problem) dependent & independent coordinate, closing error balancing of a traverse by Bowditch's method & transit method (no analytical problems), adjustments. **Global Positioning System**: Definition, Principles of GPS, DGPS and its applications. Methods of processing GPS, DGPS data, A Concepts of rapid, static methods with GPS, DGPS - semi-Kinematic, pure Kinematic and Real time kinematic methods – Applications and Case studies. **UAV surveying:** Definitions of UAV, RPA, Quad copters -Basic Components and Categories – Applications, Principles of Flight Planning, Mapping and Surveying, Comparison with other aerial vehicles, Case Studies: Agriculture Weed Classification, Land use and Land cover, Microdrone surveillances	**09**

Expt. No	**LABORATORY EXPERIMENTS:**	**No. of Sessions**
1	To set regular geometric figure (Pentagon) and to find the distance between two inaccessible points, using chain, tape and prismatic compass.	**10**
2	To find the distance between two inaccessible points shown in the field using Theodolite.	
3	To determine the difference in elevation between various points by differential levelling using Auto level and Total Station.	
4	To find the true difference in elevation between various points by profile levelling and cross-section method using Total Station	
5	To establish contour of a given area by Block leveling using Total station	
6	To establish simple circular curve using Rankine's deflection method using Total station	
7	To set out a compound curve using Deflection angle method using Total station	
8	Convert, Extract, overlaying analysis of given data(exp no 3-no 7) using Q-GIS software	
9	Georeferencing and Digitization of a given toposheet using Q-GIS Software.	
10	Demo: GPS,DGPS and UAV/Drone	

Course Outcomes: At the end of the course the student will be able to	
1	Execute survey using Optical Survey Instruments and EDM
2	Find the level of ground surface and Calculation of area and volumes
3	Operate GPS, UAV For Field Execution
4	Preparation & digitization of different topography map with the help of GIS software

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations, YouTube videos.

Suggested Text Book(s):	
1	Surveying By B. C. Punmia, Ashok Kumar Jain, Arun Kuma Jain, lakshmi publication, Vol. 1, 2 & 3.
2	Surveying and leveling, T P Kanetkar, Pune Vidyarthi Griha Prakashan
3	Surveying and Leveling – R Subramanian. Oxford University Press (2007)
4	Fundamentals of Surveying - Milton O. Schimidt – Wong, Thomson Learning
5	Surveying Vol. I, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi.

Suggested Reference Book(s):	
1	'Higher Surveying' A.M. Chandra New age international (P) Ltd
2	Fundamentals of Surveying - S.K. Roy – Prentice Hall of India
3	Text Book of Surveying – C. Venkataramiah. Universities Press. (2009 Reprint)
4	Plane and Geodetic Surveying by David Clark Vol I and II, CBS Publishers.

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
http://nptel.ac.in https://swayam.gov.in

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE).

A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester.

First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester.

The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason.

Two assignments each of **05 Marks (taken average at the end)**

First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.

Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**)

CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the CO^{s} and PO^{s} and PSO^{s}.

At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.

(For each CIE, the portion of the syllabus should not be common / repeated).

CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO - PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓				✓			✓
CO2	✓	✓	✓	✓					✓			✓
CO3	✓	✓		✓	✓		✓		✓			✓
CO4	✓		✓	✓	✓	✓	✓		✓	✓		✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**GEOLOGY AND CONSTRUCTION MATERIALS**						
Course Code	**21CVT304**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week						
	L	T	P	SS	Total	Total Teaching Hours	Credits
	3	0	0	0	3	40	3
CIE Marks:50	**SEE Marks:50**		**Total Marks:100**		**Duration of SEE:03 Hours**		

Course Objectives:	
1	Understand the engineering properties of various materials used in civil engineering applications.
2	Learn the techniques involved in designing the components of buildings and method of construction.
3	Acquire knowledge about the different elements of the building and understanding environmentally sustainable building techniques.

Unit No.	Syllabus	No. of Hours
I	**PHYSICAL GEOLOGY:** Geology in civil engineering – branches of geology – structure of earth and its composition – weathering of rocks – scale of weathering – soils – landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics.	**08**
II	**MINEROLOGY AND PETROLOGY:** Physical properties of minerals – Quartz group, Feldspar group, Pyroxene – hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals. Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.	**08**
III	**INTRODUCTION TO BUILDING MATERIALS:** **STONES & BRICKS:** Quarrying of stones, Tests on stones, properties and uses, Deterioration and preservation of stone work, Ingredients of good brick earth, manufacturing of Bricks, classification and qualities of bricks, Test on Bricks. **CEMENT & CEMENT CONCRETE BLOCKS:** Ingredients, Manufacturing, types. **TIMBER:** Timber, classification, seasoning of timber. Defects in timber, preservation of timber, uses & their properties. Plywood, Block Board, Particle Board, Laminates.	**08**
IV	**FOUNDATION:**	**08**

	Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations, Deep Foundation **MASONRY:** Classification and Joints in stone masonry, Introduction to load bearing and partition walls. Bonds in Brick work - English Bond, Flemish Bond, and Reinforced Brick Masonry, Characteristics and requirements of good brick masonry. **ARCHES:** Elements of an arch, Classification of arches, Stability of arch	
V	**DOORS, WINDOWS AND ROOFS:** Types of Doors and Windows, Types of Roofs & Roofing materials, Trusses. **STAIRS AND FORM WORK**: Requirements of good stair, Types of Stairs and, Geometrical design of RCC Dog-legged and open well stairs. Introduction to formwork and scaffolding, Formwork details for RCC Column, Beams and Floors, Shoring and under pinning. **GREEN BUILDING:** Green Design, Green Construction Methods, Energy Auditing, Green Products, Life-Cycle Assessment and Precast building, Passive Design Strategy, Carbon Footprint.	**08**

Course Outcomes:	
1	Apply geological knowledge in different civil engineering practice.
2	Acquire knowledge on stones, bricks, timber, cement, types of foundations, classification of Masonry structures, arches and their applications.
3	Understand types of doors, windows and roofs. Explain the construction of Staircase and learn damp proofing, green building concept.

Teaching - Learning Process	Chalk and talk, videos, Power Point Presentation; Group Discussions with assignments; Group Activity

Suggested Text Book(s):	
1	Building Construction, B.C Punmia, India.
2	Building Construction, Rangawala P.C. Charter Publishing House, Anand, India.
3	Building Construction, Sushil Kumar, Standard Publication and Distributors, New Delhi.
4	Chenna Kesavulu N., Textbook of Engineering Geology, Macmillan India Ltd., 2009.
5	Gokhale K.V.G.K, Principles of Engineering Geology, B.S. Publications, Hyderabad 2011.
6	Dr. Adv. Harshul Savla, Green Building: Principles & Practices
7	Parbin Singh. A, Text book of Engineering and General Geology, Katson publishing house, Ludhiana 2009.

Suggested Reference Book(s):	
1	A Text Book Building Materials, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication.
2	Engineering Materials, Rangawala P.C. Charter Publishing House, Anand, India.

3	Concrete Technology – Theory and Practice, M.S. Shetty, S. Chand and Co, New Delhi, 2002.
4	Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
5	Bell F.G., Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
6	Dobrin M.B, An introduction to geophysical prospecting, Tata McGraw Hill Pvt. Ltd, New Delhi, 1988

Other useful e-resources:	
1	https://www.youtube.com/watch?v=sTYao4RZck&list=PLDF5162B475DD915F&index=3
2	https://www.youtube.com/watch?v=EBiLLJAxBuU&index=2&list=PLDF5162B475DD915F

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.

First test at the end of 5^{th} week of the semester and Second test at the end of the 10^{th} week of the semester.

The makeup test at the end of the 15^{th} week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.

Two assignments each of 05 Marks (taken average at the end)

First assignment at the end of 4^{th} week and Second assignment at the end of 9^{th} week of the semester.

Group discussion/Activities / Seminar/Quiz will be planned suitably to attain the Co^{s} and PO^{s} and PS^{o}.

At the end of the 13^{th} week of the semester the sum of two tests, two assignments and Group discussion/Activities /Seminar/Quiz will be Scaled out of 50 marks.

(For each CIE, the portion of the syllabus should not be common/repeated).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration **03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units/module. Each of the two questions under a Unit/module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module. The students have to answer 5 full questions. Selecting one full question from each Unit/module.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓					✓	✓				✓
CO2	✓				✓		✓	✓				✓
CO3	✓				✓	✓	✓	✓				✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**CONSTRUCTION MATERIALS LABORATORY**						
Course Code	**21CVL305**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	S	Total		
	0	**0**	**2**	**0**	**2**	**26**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: Make the Students to learn	
1	To analyses the bituminous material behaviour & their properties for the effectiveness of various projects.
2	To classify and select the suitable aggregate material for the infrastructural projects.
3	To impart knowledge on the various factors governing the Engineering behaviour of soils and the suitability of soils for road construction.

Sl No.	**Syllabus contents**	**Teaching Hours**
1	**Test on Coarse Aggregates:** a) Specific Gravity, water absorption test & Sieve Analysis b) Impact test c) Crushing test d) Abrasion test e) Size and shape test (Flakiness & Elongation Index, Angularity number)	**08**
2	**Test on fine Aggregates:** a) Specific Gravity b) Bulking of sand c) Sieve Analysis	**02**
3	**Test on Bitumen:** a) Specific Gravity b) Penetration c) Ductility d) Softening point e) Flash & fire f) Viscosity	**06**
4	**Test on Soil:** a) Wet sieve analysis b) CBR test c) In-situ Density test by i. Core Cutter method. ii. Sand Replacement method.	**06**
5	**Bituminous Mixes:**	**04**

	Proportioning of aggregate mixes by Rotchfutch Method, Marshall Stability Tests (Demo).	

C**ourse Outcomes:** At the end of the course the students will be able to	
1	Evaluate the characteristics of aggregates and their physical properties suitable for construction activities
2	Discuss the behavior of bituminous material with different climatic conditions and their Engineering properties
3	Assess the characteristics of soil and their physical properties suitable for construction activities

Suggested Text Book(s):	
1	Highway Material Testing Laboratory Manual by Khanna S K and Justo CEG Nemi Chand & Bros.
2	M. L. Gambhir: Concrete Manual: Dhanpat Rai & sons New – Delhi
3	Relevant IRC codes and MoRTH specifications.

Suggested References:	
1	https://morth.nic.in/sites/default/files/5-volume-5-january1998-december-2001.pdf
2	https://law.resource.org/pub/in/bis/irc/mort.250.2013.pdf
3	IS 2386-3: Methods of test for aggregates for concrete, Part III: Specific gravity, density, voids, absorption and bulking, Bureau of Indian standards, (1963).
4	IS 2386-4: Methods of test for Aggregates for concrete Part IV: mechanical properties of a) Specific Gravity, water absorption test & Sieve Analysis Impact test Crushing test Abrasion test Size and shape test (Flakiness & Elongation Index, Angularity number) , Bureau of Indian standards, (1963).
5	IS: 1202: Determination of specific gravity of Bitumen, Bureau of Indian standards,(1978)
6	IS: 1203: Determination of penetration of Bitumen, Bureau of Indian standards,(1978).
7	IS: 1205: Determination of softening point of Bitumen, Bureau of Indian standards,(1978).
8	IS: 1208: Determination of ductility of Bitumen, Bureau of Indian standards,(1978).
9	IS: 1209: Determination of flash point and fire point of Bitumen, Bureau of Indian standards,(1978).
10	IS: 1206: Methods for testing Tar and bituminous materials (Part I), Determination of viscosity, Bureau of Indian standards, (1978).
11	IS: 2720: Grain size analysis of soil by wet sieve analysis, (Part IV), Bureau of Indian standards, (1985).
12	IS: 2720: Determination of dry density of Soils in-place by the core-cutter method (Part XXIX), Bureau of Indian standards (1978).
13	IS: 2720: Determination of dry density of Soils in-place by the sand replacement method (Part XXVIII), Bureau of Indian standards (1974).
14	IS: 2720: Laboratory determination of CBR (Part XVI), Bureau of Indian standards, (1987).
15	ASTM D6927-06: Standard Test Method For Marshall Stability And Flow Of Bituminous Mixtures0

Assessment Details (both CIE and SEE):
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

- ✓ CIE marks for the practical course is 50 Marks.
- ✓ The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- ✓ Each experiment to be evaluated for conduction with observation sheet and record write- up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- ✓ Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- ✓ Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- ✓ Weightage to be given for neatness and submission of record/write-up on time.
- ✓ Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- ✓ In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- ✓ The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- ✓ The average of 02 tests is scaled down to 20 marks (40% of the maximum marks).
- ✓ The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

CO & PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓			✓			✓	✓	✓
CO2	✓	✓					✓		✓		✓	✓
CO3	✓	✓					✓		✓		✓	✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**PHOTOGRAMMETRY AND REMOTE SENSING**						
Course Code	**21CVT3081**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	**No. of Hours/Week**					**Total Teaching Hours**	**Credits**
	L	**T**	**P**	**SS**	**Total**		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks:50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01 Hours**		

Course Learning Objectives:	
1	Familiarize the various approaches of photogrammetry and its principles.
2	Understand the concept of Digital Photogrammetry by different methods and Remote sensing.
3	Apply the concept of sensors and platforms through various categories of satellites with their specific applications.

UNIT – I	
Photogrammetry: Metric photogrammetry- interpretative photogrammetry- Types of Photographs Terrestrial photographs- Aerial photography- Taking Vertical Aerial Photographs- Existing Aerial Photography- Application of Photogrammetry- Photogrammetry and Geographic Information Systems	**3 Hrs**
UNIT – II	
Principles of Photogrammetry: Theory of Photogrammetric Orientation- Photographic Resolution- Ground Coverage- 3D Rotation Photogrammetric Techniques- photographic devices- Instruments for Traditional and Digital Photogrammetry- 3D Visualization	**3 Hrs**
UNIT – III	
Digital Photogrammetry: Ground sampling distance-Photogrammetric Measurements- Using stereoscopic aerial photographs Digital photogrammetric techniques-Relating Focal length to altitude-Scale of vertical aerial photo over variable terrain-Height measurement from single aerial photos-Relief Displacement –Digital Photogrammetric station.	**3 Hrs**
UNIT – IV	
Remote Sensing: Introduction - Physics of Remote Sensing - Electromagnetic Radiation (EMR) - Blackbody Radiation - Planck's Law - StefanBoltzmann Law - Wien's Displacement Law - Components of Remote Sensing - Atmospheric Windows and Blinds - Interaction of EMR with atmosphere, and Earth's surface: soil, water and vegetation - Remote Sensing Platforms and Sensors – Image Interpretations	**3 Hrs**
UNIT – V	

Sensors and platforms: Platforms – types and their characteristics 2.2 Satellites and their characteristics – geo-stationary and sun-synchronous, Earth Resources Satellites -LANDSAT, SPOT, IRS, IKONOS satellite series, Meteorological satellites – INSAT, NOAA, GOES , Sensors – types and their characteristics, Basic concept and principles of thermal, microwave and hyperspectral sensing, Basic principles, types, steps and elements of image interpretation	**3 Hrs**

Course Outcomes: The students will be able to	
CO1	Classify and apply the concept and principles of photogrammetry.
CO2	Illustrate the digital outcome of the photogrammetry and remote sensing.
CO3	Validate the application of sensors and platforms in image interpretation.

Process of Assessment (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Two Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5thweek of the semester
2. Second test at the end of the 10thweek of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4thweek of the semester
2. Second assignment at the end of 9thweek of the semester

Group discussion / Activities /Seminar/ Quiz 05 Marks (duration 01 hours), and it is suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of two tests, two assignments, and Group discussion / Activities /Seminar/ Quiz will be for50 marks and shall be scaled for the same.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

Course Outcomes: The students will be able to	
CO1	Classify and apply the concept and principles of photogrammetry.
CO2	Illustrate the digital outcome of the photogrammetry and remote sensing.
CO3	Validate the application of sensors and platforms in image interpretation.

Suggested Text Book(s):	
1	Campbell, J.B. (2006). Introduction to Remote Sensing. 4th edn. Guilford Press.

2	P.R. Wolf: 2000 (2nd) Ed, Elements of Photogrammetry, McGraw Hill ins.

Suggested Reference Book(s):	
1	Cracknell, A. (2007). Introduction to Remote Sensing 2nd. edn. Taylor and Francis.
2	Rampal, K.K., (2004), Textbook of Photogrammetry, John-Wiley & Sons
3	Lillesand T.M., Kiefer R.W. and Chipman J.W. (2003) Remote Sensing and Image Interpretation, 5th ed., Wiley.
4	Zorn H.C. (1980) Introductory Course in Photogrammetry, 6th Ed. ITC, Netherlands.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓	✓	✓					✓
CO2	✓	✓			✓		✓		✓			✓
CO3	✓			✓	✓		✓					✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**SUSTAINABLE MATERIALS AND GREEN BUILDINGS**						
Course Code	**21CVT3082**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks:50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01 Hours**		

Course Objectives:	
1	Understand the Concepts of effective utilization of alternative building materials.
2	Learn the solar energy efficient strategies in Green buildings.
3	Learn the management of Solid Waste.

Syllabus	**No. of Hours**
Unit - I	
Introduction to alternative building Materials: Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime Pozzolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo-	**3 Hrs**
Unit - II	
Cost effective Building Technologies: Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames	**3 Hrs**
Unit - III	
Passive Solar Techniques: Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions	**3 Hrs**
Unit - IV	
Green Buildings: Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling	**3 Hrs**
Unit - V	
Green Composites for Buildings: Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes.	**3 Hrs**

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

1	Analyze and Discuss the Basic Concept of Ecology and its Divisions, Environment, Interactions Among Organisms and Autecology of Species.
2	Characterize and Explain Soil Science, Biogeographic Regions and Vegetation of India.
3	Identify the Land Pollution and its Effect on Biodiversity and Wildlife Conservation.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations, site visit to experience the ecological system of any type.

Suggested Text Book(s):	
1	HarharaIyer G, Green Building Fundamentals, Notion Press Construction Equipment and its Management - Sharma,S. C.: Khanna Publishers.
2	Dr. Adv. HarshulSavla, Green Building: Principles & Practices

Suggested Reference Book(s):	
1	"Green Building Fundamental" – G.HariharaIyer.
2	"Sustainable Construction"- Charles J. Kibert.

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
http://nptel.ac.in https://swayam.gov.in https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham https://www.youtube.com/watch?v=THgQF8zHBW8 https://www.youtube.com/watch?v=DRO_rIkywxQ

Process of Assessment (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Two Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5thweek of the semester
2. Second test at the end of the 10thweek of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4thweek of the semester
2. Second assignment at the end of 9thweek of the semester

Group discussion / Activities /Seminar/ Quiz **05 Marks** (**duration 01 hours**), and it is suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of two tests, two assignments, and Group discussion / Activities /Seminar/ Quiz will be for50 marks and shall be scaled for the same.

Semester End Examinations (SEE)
SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

CO - PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓	✓	✓					
CO2	✓				✓	✓	✓					
CO3	✓				✓	✓	✓	✓			✓	✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**FIRE SAFETY IN BUILDINGS**						
Course Code	**21CVT3083**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours / Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01 Hours**		

Course Objectives:	
1	Illustrate the objectives of fire safety in buildings, fire hazard analysis and classification of fire. Understanding of fire prevention, detection and alarm systems including emergency measures for control of fire.
2	Discus the firefighting arrangements, extinguishing principles, agents, appliances and firefighting services in buildings
3	Outline the fire risk management, pitfalls in the fire risk assessment process, emergency provisions and procedures and fire safety signs and notices. To understand the fire safety Standards and Codes for different firefighting devices and components.

Unit No.	Syllabus	No. of hours
I	**Fire Safety:** Introduction, causes of fire, objectives of fire safety. Theory of fire safety; fire science, fire triangle, chemical reaction for combustion (oxidation), flash point, fire point and ignition point, flammability characteristics, fire stages (life cycle of fire), explosion, fire hazards. Fire hazard analysis and assessment. Important definitions related to fire safety. Classification of fire.	**03**
II	**Prevention, Protection and Control of Fire:** Introduction, Prevention of fires; fire prevention activities, fire prevention measures, general precautions for fire prevention, Do's and Don'ts for handling fire hazards. Design requirements for fire safety; building design, ventilation, provisions of civil design. Fire Detection and Alarm Systems; fire detection, fire alarm system. Fire protection; fire protection systems, fire protection programme, facts about fire protection. Means of escape in emergency; factors affecting means of escape, evacuation (including search and rescue)	**03**
III	**Fire Fighting Arrangements:** Introduction, firefighting systems, fire extinguishing principles. Extinguishing agents and their applications; water, carbon dioxide, foam, dry chemical powder (DCP), aqueous film forming foam (AFFF), halon (halogenated hydrocarbons). Portable fire extinguishers; types of portable fire extinguishers, selection of portable fire extinguishers, general instructions for the use of fire extinguisher. Firefighting appliances, firefighting services in buildings,	**03**

	firefighting services in high rise buildings, electrical fires, quality and reliability in fire safety, fire training.	
IV	**Fire Risk Management:** Introduction, risk assessment criteria, risk assessment steps, Common pitfalls in the fire risk assessment process. Fire risk reduction and control. Fire Risk Management Action Checklist. Controlling combustible materials, reducing the potential for ignition, rapid identification and notification of the presence of fire or smoke, effective emergency provision and procedures, Control of the fire, management of fire risk. Information, training and education. Fire safety signs and notices.	**03**
V	**Fire Safety Standards and Codes:** Code and standard for Hydraulic platform, Turntable ladder and other Rescue and fire-fighting devices and components. Code, Standard and specification concerning to safety of fire-fighting personnel i.e., Breathing Apparatus P.P.E., safety gears and other devices. Code and Practice for construction of temporary structures and scaffolding.	**03**

Course Outcomes: At the end of the course the student will be able to :	
1	Understand the definition of fire, fire triangle, combustion process and fire stages. Fire hazard analysis and assessment. Acquire the knowledge of fire prevention, protection and control systems.
2	Describe different firefighting arrangements in the building.
3	Illustrate fire risk analysis and management including fire safety signs and notifications. Application of Fire Safety Standards and Codes for design of firefighting devices and components.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations and the online courses available should be shared with students. Field visit to fire stations and understand various fire accidents.

Suggested Text Book(s):	
1	S. C. Sharma & Vineet Kumar, Safety, Occupational Health and Environmental Management in Construction, Khanna Publisher ISBN No. 978-81-7409-270-0, 2nd edition 2019.
2	N. Sesha Prakash, Manual of Fire Safety, CBS Publishers & Distributors Pvt. Ltd, 2020.
3	Charles D Reese, Occupational Safety and Health Fundamental Principles and Philosophies, CRC Press, 2017
4	V K Jain, Fire Safety in Buildings, ISBN-13 978-938980219, New Age International Private Limited; Third edition, 2020
5	Fire protection, services and maintenance management of building, NPTEL video lecture, IIT, Delhi
6	Bureau of Indian Standards, "Hand Book of Functional Requirements Of Buildings, (SP-41 & SP- 32)", BIS 1987 and 1989.
7	Building Services Design - T. W. Mever, Published by RIBA Publications, 1971, ISBN 10: 0900630167
8	Building Engineering & System Design - F. S. Merrit & J. Ambrose, U. S Department of Energy Office of Scientific and Technical Information, 1990.
9	National Building Code of India- Part: 4, Fire and Life safety, Bureau of Indian Standard.
10	Concept of building fire safety - D. Egan, Krieger Publishing Company, 2006.

11	Design of fire resisting structures - H. L. Malhotra. Surrey University Press, 1982.
12	https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/lab_admin/documents/genericdocument/wcms_828851.pdf
13	https://dgfscdhg.gov.in/national-building-code-india-fire-and-life-safety
14	https://www.firepedia.in/indian-standards-on-fire-safety

Suggested Reference Book(s):	
1	An Introduction to Fire Dynamics -D. Drysdale, 2rd Edition, Wiley Publisher. ISBN: 978-1-119-97610, 2011
2	Structural Fire protection Edt by T.T. Lie, Published June 1992 by American Society of Civil Engineer
3	Building Maintenance Management-R. Lee, Wiley Publisher
4	Developments In Building Maintenance -I. E. J. Gibson, Applied Science Publishers,1978

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
https://archive.nptel.ac.in/courses/105/102/105102176/

Activity Based Learning (Suggested Activities in Class) / Practical Based learning
Assignment for Students: A case study of fire hazard in building and restoration procedure adopted

Process of Ascertaining (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Two Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**), and it is suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be for 50 marks and shall be scaled for the same.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

CO - PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓	✓	✓		✓					
CO2	✓			✓	✓		✓					
CO3	✓						✓					

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**PAVEMENT MATERIALS AND CONSTRUCTION**						
Course Code	**21CVT3084**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 02 Hours**		

	Course Objectives:
1	Expose to the different materials which are used in pavement construction, impart knowledge about the engineering properties required.
2	To get knowledge about different highway construction equipment with their suitability and adaptability in various field scenarios.
3	Expose to construction practice and quality control aspects of flexible and rigid pavement as per the required specifications (MORTH).
4	To introduce the possible improvisation in various layers of pavement to increase the structural strength by the use of non-basic materials (DLC, polythene sheets).

Unit No.	Syllabus	No. of Hours
I	**Sub grade:** Introduction, properties and tests. **Aggregates:** Origin, Classification, Requirements, properties, Proportioning of aggregate mixes by Rotchfutch Method and tests on Road aggregates.	**03**
II	**Bitumen and Tar**: Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements. **Bituminous emulsion and Cutbacks**: Preparation, Characteristics, uses and test.	**03**
III	**Equipments in highway construction:** Various types of equipments for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.	**03**
IV	**Flexible Pavements**: Specifications of materials, Construction method and field control checks for various types of flexible pavement layers.	**03**
V	**Cement Concrete Pavements:** Specifications and method of cement concrete pavement construction (PQC, importance of providing DLC as sub base and polythene thin layer between PQC and sub base, white topping). Quality control tests.	**03**

Course Outcomes: At the end of the course the student will be able to :	
1	Evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS, IRC specifications
2	Proficient to adapt suitable modern technique and equipment for speedy and economic construction.
3	Execute the construction of subgrade, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

Teaching Learning Process: These are sample Strategies, which the teacher can use to accelerate the attainment of the various course outcomes.	
1	Chalk and talk, Power point Presentation, Video.
2	NPTEL materials.
3	Quiz/Assignments/Open book test to develop skills.
4	Encourage collaborative learning in the class with site visits related to the subject and impart practical knowledge.

Suggested Text Book(s):	
1	Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2	Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3	Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University ofTexas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

Suggested Reference Book(s):	
1	Relevant IRC codes and MoRTH specifications.
2	www.nptel.ac.in
3	www.swayam.ac.in
4	https://onlinecourses.nptel.ac.in/noc22_ce93/preview
5	https://www.youtube.com/watch?v=XOyusu4QC8s: Pavement Materials 1 – Part-1
6	https://www.youtube.com/watch?v=Ivmo27N3ojo&list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT&index=47 : Pavement Materials 1 – Part-2
7	https://www.youtube.com/watch?v=V5iz3ATzMDE&list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT&index=48 : Pavement Materials 2 – Part-1
8	https://www.youtube.com/watch?v=UxAjLtFgO0Q&list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT&index=49 : Pavement Materials 2 – Part-2
9	https://www.youtube.com/watch?v=V5iz3ATzMDE&list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT&index=48 : Pavement Materials 2 – Part-1
10	https://www.youtube.com/watch?v=UxAjLtFgO0Q&list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT&index=49 : Pavement Materials 2 – Part-2

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
Seminars / Quiz (to assist in GATE preparations). Demonstrations in the lab. Self-Study on simple topics.

Virtual lab experiments.

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE).

A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester.

First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester.

The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason.

Two assignments each of **05 Marks (taken average at the end)**

First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.

Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**)

CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the CO^{s} and PO^{s} and PSO^{s}.

At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.

(For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO - PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓					✓
CO2	✓				✓		✓		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓		✓		✓		✓	✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**WATER SUPPLY AND SANITARY ENGINEERING**						
Course Code	**21CVT402**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**2**	**0**	**5**	**50**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	Analyze the variations of water demand, sources, collection and conveyance system, and quantify the amount of water requirement for a community.
2	Study the drinking water quality, standards, qualitative analysis and various treatment methods to attain the required water quality standards.
3	Applying the mind to learn and understand the importance of providing the water carriage system of sewerage at all places, quantification and characterization of sewage.
4	Acquiring the knowledge and importance of waste water treatment and disposal with sustainable concept.

Unit No.	**Syllabus**	**No. of Hours**
I	**INTRODUCTION:** Water supply engineering, importance and necessity of planned w/s, water treatment, importance and reliability of water works. **WATER DEMANDS:** Various types, total requirement of water for a town or a city, per capita demand, factors affecting percapita demand, variations in demand, factors affecting losses and wastes, effect of variations in demand on the design capacities of water supply components, design periods, population data and population growth, population forecasting methods.	**08**
II	**SOURCES:** Surface and subsurface sources – suitability with regard to quality and quantity. **COLLECTION AND CONVEYANCE OF WATER:** Intakes, types of intakes. Conveyance of water; open channel, aqueducts, tunnels, flumes, pipes of different types, joints. **QUALITY OF WATER:** Wholesome water, impurities in water, physical tests, chemical tests, biological tests, standards of water quality. Maintenance of purity of water – water borne diseases, suitability of water for trade purposes.	**08**
III	**WATER TREATMENT AND DISTRIBUTION:** General introduction, objectives of water treatment, methods of water treatment, screening, aeration, plain sedimentation, sedimentation with coagulation, filtration, types of filters –	**08**

	sand filters, pressurefilter-operational problem in filters. **DISINFECTION OF WATER:** Requirements of disinfectants, methods of disinfection; disinfection, chlorination, chlorine demand, breaking point chlorination, super chlorination, de-chlorination, residual chlorine, miscellaneous treatments. **DISTRIBUTION:** Methods of water distribution- gravity, pumping, combined gravity and pumping system. Dead end, radial, circular system, Hardy cross method, Hazen William formula.	
IV	**SANITARY ENGINEERING:** Introduction, types of sewage and types of sewerage system, components of sewerage system. System of sanitation, methods of collection, conveyance system with its merits and demerits, water carriagesystem with its merits and demerits. Sewerage system, separate, combined and partially separate systems with their merits and demerits, comparison of these studies, patterns of collection system. **QUANTIFICATION OF SEWAGE:** Sources of sewage, factors affecting sewage, determination of rainfall intensity, quality of storm water, the rational method, runoff coefficient, empirical formula for rainfall intensities, time concentration, numerical problems. **CHARACTERISATION OF SEWAGE:** Physical, chemical and biological characteristics, decomposition of sewage, examination and sampling of sewage, solids- total solids, volatile solids, suspended solids, dissolved solids, fixed solids, determination of DO, BOD rates, COD, Chlorides and Sulphides, Nitrogen, P^H, oil and grease, fat.	**08**
V	**TREATMENT AND DISPOSAL OF SEWAGE:** Classification of treatment processes; screening, grit removal, oil and grease removal, sedimentation design, sedimentation aided with coagulation design, treatment through biological filtration, activated sludge process design, TF's, rotatory biological contactors (RBC), oxidation ponds and aerated lagoons, anaerobic treatment; septic tank, Imhoff tanks, sludge treatment, sludge drying. **DISPOSAL OF SEWAGE:** Disposal by dilution, land disposal, sewage farming.	**08**

Expt. No	LABORATORY EXPERIMENTS	No. of Sessions
1	Determination of Acidity and Alkalinity, pH and Turbidity.	**10**
2	Determination of Hardness by EDTA method.	
3	Determination of Chlorides in drinking water sample.	
4	Determination Residual Chlorine and Chlorine demand.	
5	Determination of D.O content.	
6	Determination of Total solids in Municipal sewage.	
7	Determination of BOD of Combined wastewater.	
8	Determination of C O D of Combined waste water.	

9	Determination of Optimum Coagulant dosage (ALUM)	
10	Determination of MPN. (DEMO EXPERIMENT)	

Course Outcomes: At the end of the course the student will be able to	
1	Analyse the various water demand, quantify the requirement, selection of suitable source and plan for suitable intake structures for supply water for a community.
2	Evaluate the water source for physical, chemical and biological characteristics, select and design a suitable treatment processes for the source and also a suitable distribution methods to fulfill the various water demand of a society.
3	Apply the knowledge to manage the sewage and sewerage systems, quantify the sewage generated by various activities and also its characteristics.
4	Plan and design a suitable wastewater treatment process's, disposable methods, and also use various laboratory analytical methods for water and wastewater analysis.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations, visit to in around water and waste water treatment plants, disposal and reuse Units.

Suggested Text Book(s):	
1	Water Supply and Sewerage, Steel. E. W. & Terence J. M. Ghees, Mc Graw – Hill International Book Co.
2	Water Supply & Sanitary Engineering, G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company (2015, Ninth Edition)
3	Wastewater Engineering – S. K. Garg, Khanna Publishers
4	Environmental Engineering II – B. C. Punmia and Ashok Jain

Suggested Reference Book(s):	
1	Water and waste water Engineering Vol-II- fair, Gayer and Okun, Willey publishers, New York.
2	Wastewater Treatment, Disposal and Reuse, Metcalf and Eddy Inc. Tata Mc Graw Hill Publications (2003 Edition).
3	Water and Wastewater Technology-SI Version, Hammer. M. J. (1986), 2nd Edition, John Wiley and Sons.
4	Environmental Engineering, Peavy, H. S., Rowe, D. R. and Tchobanoglous, G. McGraw Hills, New York 1985.

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
http://nptel.ac.in https://swayam.gov.in https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

Process of Ascertaining (both CIE and SEE):
50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End

examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester.

First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester.

The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason.

Two assignments each of **05 Marks (taken average at the end)**

First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.

Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**)

CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the COs and POs and PSOs.

At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.

(For each CIE, the portion of the syllabus should not be common / repeated).

CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO - PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓	✓		✓			✓
CO2	✓	✓	✓	✓		✓	✓		✓			✓
CO3	✓	✓				✓	✓		✓			✓
CO4	✓	✓	✓		✓	✓	✓		✓	✓		✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**FLUID MECHANICS AND MACHINERY**						
Course Code	**21CVT403**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**2**	**0**	**5**	**50**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	Understand fundamentals of fluid properties, fluid pressure and hydrostatic laws.
2	Gain knowledge on fluid dynamics and basic design of flow through pipes.
3	Able to measure flow of fluid with different devices.
4	Understand the working principles and performance of hydraulic machines.

Unit No.	Syllabus	No. of Hours
I	**BASIC PROPERTIES OF FLUIDS:** Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension, Capillarity and vapour pressure, Numericals. **PRESSURE AND ITS MEASUREMENT:** Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure, Measurement of pressure using simple, differential manometers and mechanical gauges. Numericals.	**08**
II	**DYNAMICS OF FLUID FLOW:** Introduction, Energy possessed by a fluid body. Euler's equation of motion along a streamline and Bernoulli's equation. Practical Applications of Bernouli's equation (Venturimeter, Orificemeter). Problems on applications of Bernoulli's equation. **FLOW THROUGH PIPES:** Losses in pipe flow, Darcy-Weisbach equation for head loss due to friction in a pipe, Minor losses in pipe flow, Numericals.	**08**
III	**DEPTH AND VELOCITY MEASUREMENTS, NOTCHES AND WEIRS:** **Measurement of depth:** Point and hook gauges, self-recording gauges. Staff gauge, Weight gauge, float gauge. **Measurement of velocity:** Pitot tube, Current meter. **Discharge measurements:** Small orifices, mouth pieces, Rectangular notch, Triangular notch, Cipolletti notch, Ogee weir and Broad crested weir, Numericals.	**08**
IV	**UNIFORM FLOW OVER OPEN CHANNELS:**	**08**

	Geometric properties of Rectangular, Trapezoidal. Chezy's equation, Manning's equation-problems. Most economical open channels - Rectangular, Trapezoidal channels, Numericals. **NON-UNIFORM FLOW OVER OPEN CHANNELS:** Specific energy diagram, Conditions for Critical flow. Hydraulic jump in a Horizontal Rectangular Channel, Numericals.	
V	**IMPACT OF JET ON VANES:** Force exerted by the jet on stationary and moving flat and curved vanes, numericals. **TURBINES:** Classification of turbines, working principles of impulse (Pelton) and reaction (Francis and Kaplan) turbines, unit quantities, numericals. **CENTRIFUGAL PUMPS:** Classification, Priming, working Principles, minimum starting speed, multi-stage Centrifugal Pumps (pumps in series and parallel), characteristic curves, numericals.	**08**

Expt. No	LABORATORY EXPERIMENTS	No. of Sessions
1	Verification of Bernoulli's equation.	**10**
2	Determination of Hydraulic coefficients of a vertical orifice.	
3	Calibration of Rectangular and 90^0 V-notch.	
4	Calibration of Broad- crested weir and Ogee weir.	
5	Calibration of Venturimeter and Orificemeter.	
6	Determination of Darcy's friction factor for a straight pipe (PVC and GI).	
7	Determination of vane coefficients for a fixed flat, inclined and semi-circular vane.	
8	Performance characteristics of a Pelton wheel Turbine.	
9	Performance characteristics of a Kaplan turbine and Francis Turbine.	
10	Performance characteristics of a single stage and multi-stage Centrifugal Pump.	

Course Outcomes: At the end of the course the student will be able to	
1	Understand fundamental properties of fluids and solve problems on hydrostatics.
2	Apply principles of Bernoulli's and compute discharge losses in flow through pipes.
3	Compute discharge through orifice, notches and weirs.
4	Design of open channels of various cross sections and operational functions of hydraulic machines.

Suggested Text Book(s):	
1	A Text Book of Fluid mechanics & Hydraulic Machines'- R.K. Rajput, S. Chand & Co, New Delhi, 2006 Edition.
2	'Principles of Fluid Mechanics and Fluid Machines'- N. Narayana Pillai, Universities Press (India), Hyderabad, 2009 Edition.
3	'Text Book Of Fluid Mechanics & Hydraulic Machines'- R.K. Bansal, Laxmi Publications, New Delhi, 2008 Edition.
4	Hydraulics and Hydraulic Machines- Dr. P. N. Modi and Seth, McGraw Hill Publications.

Suggested Reference Book(s):	
1	Fundamentals of Fluid Mechanics – Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, Wiley India, New Delhi, 2009 Edition.
2	'Introduction To Fluid Mechanics' – Edward j. Shaughnessy, Ira m. Katz: James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.
3	Fluid Mechanics' – Streeter, Wylie, Bedford New Delhi, 2008(Ed)
4	Fluid Mechanics and Turbomachines'- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009 Edition.
5	Experiments in Hydraulics and Hydraulic Machines: Theory and Procedures, PHI learning Publishers, New Delhi, 2014 Edition.
6	IS: 14750 (2000) calibration of notches and weirs.
7	IS: 4477 - 2 (1975) calibration of venturimeter and orificemeter.
8	IS: 2951 – 1 (1965) Darcy's flow through pipes losses.
9	IS: 1710 (1989) Turbines and Pumps operational characteristics.

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
Seminars / Quiz (to assist in GATE preparations). Demonstrations in the lab. Self-Study on simple topics. Virtual lab experiments.

Process of Ascertaining (both CIE and SEE):
50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together. **Continuous Internal Evaluation (CIE):** Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester. First test at the end of 5^{th} week of the semester and Second test at the end of the 10^{th} week of the semester. The Makeup test at the end of the 15^{th} week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason. Two assignments each of **05 Marks (taken average at the end)** First assignment at the end of 4^{th} week and Second assignment at the end of 9^{th} week of the semester. Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**) CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the CO^s and PO^s and PSO^s. At the end of the 13^{th} week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.

(For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							✓
CO2	✓	✓			✓							✓
CO3	✓		✓				✓			✓		✓
CO4		✓										✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**STRUCTURAL ANALYSIS**						
Course Code	**21CVT404**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

	Course Objectives: Make the Students to learn
1	Understand the concept of determinate structures, indeterminate structures, deflection and strain energy.
2	Influence line diagram for beams subjected to rolling loads and analysis of truss, arches and cables.
3	Analysis of beams and frames by moment distribution method, slope deflection method and matrix methods.

Unit No.	**Syllabus**	**No. of Hours**
I	**STRUCTURAL SYSTEMS:** Forms of structures, Conditions of equilibrium, Degree of freedom, Linear and Nonlinear behavior, One, two, three dimensional structural systems, Determinate and indeterminate structures [Static and Kinematics]. **ANALYSIS OF TRUSSES:** Method of joints and Method of sections,	**08**
II	**DEFLECTION OF BEAMS -** Moment area method, Conjugate beam method. **DEFLECTION OF TRUSS**: Unit load method. **STRAIN ENERGY :** Strain energy and complimentary strain energy, Strain energy due to axial load, bending and shear, Theorem of minimum potential energy, Law of conservation of energy, and Principle of virtual work.	**08**
III	**ROLLING LOAD AND INFLUENCE LINES:** Rolling load analysis for simply supported beams for several point loads and UDL. Influence line diagram for reaction, SF and BM at a given section. **ARCHES AND CABLES** Three hinged circular and parabolic arches with supports at same levels and different levels, Determination of thrust, shear and bending moment, Analysis of cables under point loads and UDL, length of cables (Supports at same levels and at different levels).	**07**
IV	**MOMENT DISTRIBUTION METHOD:** Introduction, Definition of terms- Distribution factor, Carry over factor, Analysis of beams and orthogonal rigid jointed plane frames (non-sway) with kinematic indeterminacy less than/equal to three. **SLOPE DEFLECTION METHOD:** Analysis of continuous beams only.	**09**

	KANI'S METHOD: Analysis of sway frames with kinematic indeterminacy less than/equal to three.	
V	**STIFFNESS MATRIX METHOD OF ANALYSIS:** Introduction, Development of stiffness matrix for prismatic beam element and plane truss element and Analysis of continuous beams, plane truss and axially rigid plane frames by stiffness method with kinematic indeterminacy □ 3. **FLEXIBILITY MATRIX METHOD OF ANALYSIS:** Introduction, Development of flexibility matrix for prismatic beam and relationship between stiffness and flexibility matrix, analysis of continuous beams and frames.	**08**

Course Outcomes: At the end of the course the student will be able to :	
1	Understand the basic structural systems, classification and parameters required for structural analysis.
2	Interpret the concept of strain energy, moving loads, lateral and gravity loads applied in the structural systems.
3	Analyze and solve problems of determinate and indeterminate structures using various approaches.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations, visit to in around water and waste water treatment plants, disposal and reuse Units.

Suggested Text Book(s):	
1	Basic Structural Analysis, C S Reddy, Tata McGraw Hill Education Pvt. Ltd., 3rd Edition ISBN-13: 978-0070702769.
2	Theory of Structures, S Ramamrutham & R Narayan, Dhanpat Rai & Co., 9th Edition, ISBN – 13: 978-934378103.
3	Structural Analysis Vol-2, S S Bhavikatti, Vikas Publishing House Fourth Edition, ISBN-13-978-9325968806.

Reference Book(s):	
1	Structural Analysis, R C Hibbler, Pearson Publication, 8th edition, ISBN-13: 978-0132570534.
2	Elementary Structural Analysis, Norris C H, Wilbur J B, International Student edition, McGraw Hill International Book, ISBN-13: 978-8131721414.
3	Structural Analysis, Devdas Menon, Narosa Publishing House, ISBN: 978-8173197505.
4	Theory of Structures, Volume 2, S P Gupta, G S Pandit & R Gupta, Tata McGraw Hill Publication Company Ltd.

Process of Ascertaining (both CIE and SEE):
50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester.

First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester.

The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason.

Two assignments each of **05 Marks (taken average at the end)**

First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.

Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**)

CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the COs and POs and PSOs.

At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.

(For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓										✓
CO3	✓	✓	✓	✓								✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**COMPUTER AIDED BUILDING PLANNING AND DRAWING**						
Course Code	**21CVL405**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	0	**0**	**2**	**0**	**3**	**15**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	Expose to the bye-laws and develop skills to prepare civil engineering drawings using Auto-CAD.
2	Apply engineering concepts to draw various components of the structure.
3	Application of MS Excel for solving simple civil engineering problems.

Unit No.	Syllabus	No. of Hours
I	**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962. Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio.	**02**
II	**Tools in Auto-CAD:** **Drawing tools:** Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse. **Modify tools:** Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet. **Using Text:** Single line text, Multiline text, Spelling, Edit text. **Special Features:** View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawing.	**02**
III	**Simple Engineering drawings with Auto-CAD** Cross section of foundation, masonry wall. Lintel and Chajja. Line diagram for school building and primary health center.	**04**
IV	**Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings:** i) Single and Two bed room building. ii) Two storied building (Ground and First floor) iii) Pitched roof.	**05**
V	**MS Excel :** i) Draw SFD and BMD for beams subjected to point load, UDL and UVL. ii) Horizontal curves, super elevation, cutting and filling of earth work.	02

Course Outcome: The students will be able to	
1	Implement the fundamentals of building planning and drawing.
2	Use the modern tools like AutoCAD for building planning and drawing.
3	Understand and Interpret the drawings for field implementation.
4	Examine spread sheet concepts in civil engineering applications.

Teaching - Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations, visit to Industry and Residential buildings.

Suggested Text Book(s):	
1	MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing co. Ltd, New Delhi.
2	Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3	Malik RS and a Meo GS, "Civil Engineering Drawing", Asian Publishers/Computech Publication Pvt Ltd

Suggested Reference Book(s):	
1	Time Saver Standard by Dodge F.W, F.W Dodge Corp.
2	2. IS: 962-1989 (Code of practice for architectural and building drawing).
3	3. National Building Code, BIS, New Delhi.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓				✓			✓
CO2					✓				✓			✓
CO3	✓					✓		✓				✓
CO4	✓				✓	✓		✓				✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**CONSTRUCTION METHODS AND EQUIPMENTS**						
Course Code	**21CVT4081**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 02 Hours**		

Course Objectives:	
1	Basic principles of construction techniques and methods.
2	Understand terminology and Units of measurements related to equipment usage in industrial, heavy civil, and commercial projects
3	Perform comparative cost analysis, selection, application and utilization of equipment.

Unit No.	Syllabus	No. of hours
I	**CONSTRUCTION METHODS:** Conventional and Modern methods of construction of building elements. Different stages of construction. Types of formworks. Elements of pre-cast and Pre-fabricated construction.	**03**
II	**MECHANIZATION:** General data on mechanized construction equipment. Construction equipment and their characteristics. Advantages and disadvantages of Mechanization.	**03**
III	EQUIPMENT- I: Excavating and earth moving equipment, Piles and Pile driving equipment.	**03**
IV	**EQUIPMENT- II:** Lifting equipment, Drilling equipment and Blasting.	**03**
V	**EQUIPMENT MANAGEMENT:** Planning process and estimation of cost of equipment. Cost of owning and operating construction equipment. Equipment life and replacement analysis.	**03**

Course Outcomes: At the end of the course the student will be able to:	
1	Learn different methods and techniques of construction.
2	Understand the types and purpose of use of equipment.
3	Perform cost analysis and selection of equipment.

Teaching Learning Process: These are sample Strategies, which the teacher can use to accelerate the attainment of the various course outcomes.	
1	Power point Presentation, Video.
2	Video tube, NPTEL materials.
3	Quiz/Assignments/Open book test to develop skills.

4	Adopt problem based learning (PBL) to develop analytical and thinking skills.
5	Encourage collaborative learning in the class with site visits related to the subject and impart practical knowledge.

Text Book(s):	
1	Sharma, S.C., "Construction equipment and its management", Khanna Publishers., 6th Edition
2	Peurifoy R L, "Construction Planning, Equipment and Methods", Mc Graw Hill, 8th Edition.
3	Spence, W.P. and Kultermann, E., "Construction materials, methods and techniques", Cengage Learning.
4	Illingworth, J.R., "Construction methods and planning", CRC Press, 2nd Edition.

Web links and Resources:	
1	Construction methods and equipment management https://nptel.ac.in/courses/105103206

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
Seminars / Quiz (to assist in GATE preparations). Demonstrations in the lab. Self-Study on simple topics. Virtual lab experiments.

Process of Ascertaining (both CIE and SEE):
50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (20 Marks out of 50) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together. **Continuous Internal Evaluation (CIE):** Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester. First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester. The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason. Two assignments each of **05 Marks (taken average at the end)** First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester. Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**) CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the COs and POs and PSOs. At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks. (For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.

The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each Units / module. Each of the two questions under a Unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that Unit / module. The students have to answer 5 full questions, selecting one full question from each Unit / module.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			✓				✓					✓
CO2	✓	✓			✓		✓	✓				✓
CO3			✓		✓	✓					✓	✓

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
Department of Civil Engineering

Course Title	**SOIL AND WATER CONSERVATION ENGINEERING**						
Course Code	**21CVT4082**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01Hours**		

Course Objectives: To	
1	Study the concept of Soil erosion, water erosion and its classification, soil loss estimation with prediction and control measures.
2	Achieve Water erosion control measures, stabilization of sand dunes, assess rate of sedimentation and elementary lay out design procedure.
3	Gain the knowledge about grassed waterways and design, factors affecting wind erosion, design of wind breaks.

Unit No.	Syllabus	No. of Hours
I	**Soil erosion**: Introduction, causes and types, Geological and accelerated erosion, Erosion agents, Factors affecting and effects of erosion. **Water erosion**: Mechanics and forms, Gullies – Classification and stages of development of water erosion.	**03**
II	**Soil loss estimation**: Universal soil loss equation (USLE) and modified USLE, Rainfall Erosivity -estimation by KE >25 and EI 30 methods, Soil erodibility and its managementfactors. **Measurement of soil erosion:** Runoff plots, soil samplers. Gully and ravine reclamation - principles of gully control - vegetative measures, temporarystructures and diversion drains.	**03**
III	**Water erosion control measures**: Agronomical measures - contour farming, strip cropping, conservation tillage and mulching **Engineering measures**: Bunds and terraces. Bunds - contour and graded bunds - design and surplussing arrangements Terraces - level and graded broad base terraces, bench terraces - planning, Elementary design and layout procedure, contour stonewall and trenching.	**03**
IV	**Grassed waterways and design, Wind erosion**: Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures.	**03**

V	**Design of wind breaks:** Design principles of wind breaks and shelter belts and stabilization of sand dunes, Land capability classification. Rate of sedimentation, silt monitoring and storage loss intanks.	**03**

	Course Outcomes: At the end of the course the student will be able to
1	Analyze the various causes for soil and water erosion, estimate the water and soil loss in land and tanks.
2	Evaluate the soil conservation and water conservation measure by various Engineering methods and principles.
3	Examine the design principles of the wind breaks, shelter belts, and stabilization of sand dunes

	Suggested Text Book(s):
1	Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
2	Singh Gurmel, Venkataraman, C., Sastry, G. and Joshi, B.P. 1996. Manual of Soil and Water ConservationPractices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3	Dr. A Mishra and Dr. B C Mal, Soil and water conservation AGRIMOON.com

	Suggested Reference Book(s):
1	Fangmeier, W., Elliott, W.J., Workman, S., Huffman, R. and Schwab, G.O. 2005. Soil and Water Conservation Engineering, 5th Edition, Cengage Learning, Inc., Clifton Park, USA.
2	Frevert, R.K., Schwab, G.O. Edminster, T.W. and Barnes, K.K. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
3	Michael, A.M. and Ojha, T.P. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

CO - PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓	✓	✓		✓			✓
CO2	✓				✓	✓	✓		✓			✓
CO3	✓		✓				✓		✓			✓

Dr. Ambedkar Institute of Technology, Bengaluru – 560056
Department of Civil Engineering

Course Title	**ECOLOGY AND ENVIRONMENT**						
Course Code	**21CVT4083**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours / Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01 Hours**		

Course Objectives:	
1	Understand the Basic Concept and Principles of Ecology Applicable to different Levels of Organization, and Environment, and Interactions Among Organisms.
2	Investigate and Understand the Soil Science, Biogeographic Regions and Vegetation of India. Making a Start with Autecology of Species.
3	Study the Land Pollution and its Impact on Biodiversity and Wildlife Conservation

Unit No.	Syllabus	No. of Hours
I	**Introduction:** Definition of Ecology, historical background, history of ecology in India, terminology of ecology, basics concepts of ecology: Holism, Ecosystem, Succession, and Conservation, Major divisions of ecology: based on taxonomic groups, based on habitat, based on levels of organization. **Environment:** definition, scope, need for public awareness.	**03**
II	**Biotic Factor (Interactions Among Organisms):** Types of interaction: Positive interaction, Negative Interaction. **Autecology of Species:** Purpose of Autecology, biological clocks, Lebig's Law of the minimum, Shelford's Law of tolerance, Combined concept of limiting factors, Ecological concept of species and individuals.	**03**
III	**Soil Science:** What is Soil, Formation of Soil, Factors in Soil Formation, Soil Profile, Soil Classification, Climate and Soil Formation, Components and Properties of Soil. **Biogeographic Regions and Vegetation of India:** Soils of India, Climate and Climatic Regions of India, Biogeographic Regions (Zones) of India, Forest Vegetation of India, Grassland Vegetation of India, Diverse Flora and Fauna of India.	**03**
IV	**Land Pollution:** Definition, Land Use in India, Land Degradation, Causes of Land Pollution: Metal Land Pollution, Pesticide Land Pollution, Radioisotope Land Pollution, Solid Waste Land Pollution. Effects of Land Pollution, Prevention of Land Pollution.	**03**
V	**Biodiversity and Wildlife Conservation:** Definition of Biodiversity, Measuring of Biodiversity, Global Biodiversity, Conservation of Biodiversity, Ecology V/S Economy, Bioethics and Conservation, Threats to Biodiversity,	**03**

	Present Scenario of Biodiversity and Wildlife Conservation in India, National Parks and Sanctuaries.	

Course Outcomes: At the end of the course the student will be able to :	
1	Analyze and Discuss the Basic Concept of Ecology and its Divisions, Environment, Interactions Among Organisms and Autecology of Species.
2	Characterize and Explain Soil Science, Biogeographic Regions and Vegetation of India.
3	Identify the Land Pollution and its Effect on Biodiversity and Wildlife Conservation.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, animations, site visit to experience the ecological system of any type.

Suggested Text Book(s):	
1	P. N. Awadhutwar and V. S. kute "Environment Ecology and Nature Conservation" Sankalp Publication, 1 January 2022
2	Majid Husain, "Objective Environment & Ecology", GK Publications Pvt. Ltd.; Second edition, 23 November 2019.
3	Vaishali Anand "Environment and Ecology", McGraw Hill; First edition, 10 July 2020.
4	Pranav Kumar, "Fundamentals of Ecology and Environment", Pathfinder Publication; 3rd edition 1 January 2021.

Suggested Reference Book(s):	
1	P. D. Sharma, "Ecology and Environment" Rastogi Publications, Meerut, Second Reprint 2018-19.
2	Dhyeya, "Ecology & Environment", DHYEYA, 30 November 2021.
3	Vinay Kumar G.B., "Question Bank on Environment and Ecology" Oxford University Press; First edition, 1 March 2020.
4	S. Theodore Bhaskaran, "Sprint of the Blackbuck: Writings on Wildlife and Conservation in South India", Penguin India, 12 April 2010.

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:
http://nptel.ac.in https://swayam.gov.in https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

Process of Ascertaining (both CIE and SEE):
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together Continuous internal Examination (CIE) Two Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**), and it is suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be for 50 marks and shall be scaled for the same.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

CO - PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓		✓	✓					✓
CO2	✓		✓	✓		✓	✓					✓
CO3	✓		✓			✓	✓					✓

Dr. Ambedkar Institute of Technology, Bengaluru – 560056
Department of Civil Engineering

Course Title	**CARTOGRAPHY AND GIS CONCEPTS**						
Course Code	**21CVT4084**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**1**
CIE Marks:50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01 Hours**		

Course Learning Objectives:	
1	An understanding of fundamental cartographic concepts.
2	Understand and prepare different kinds of maps.
3	Recognize the benefits and limitations of some common map projections, and the fundamental importance of scale.
4	Create credible reference and thematic maps in page, tabloid, and larger sizes.
5	Develop an idea about concept and components of Geographical Information System.

UNIT – I	
CARTOGRAPHY: Principle of cartography, definitions, Elements of map, Elements of common surveyors' projections, Utility of map, Study of topo-map on 1: 50000 and 1 : 250000	**3 Hrs**
UNIT – II	
CARTOGRAPHIC TECHNIQUES: Introduction to Base materials, instruments, inks and pens. Drawing of points, lines., Point symbols, line symbols, area symbols & relief features, principles of lettering, type of lettering., Lettering devices., Map numbering, Difference between map & photo	**3 Hrs**
UNIT – III	
MAP REPRODUCTION: Process camera, photographical copying techniques, colour separation, negative. Plate making, offset and rotary printing process. Computerized Map Reproduction Technique.	**3 Hrs**
UNIT – IV	
MAP PROJECTION: Principles; Different types of projection and their properties - Mercator, Transverse Mercator (TM), Universal Transverse Mercator (UTM), Grids etc. Computation in Grid – Geographical to UTM and vice versa.	**3 Hrs**
UNIT – V	
GIS (Geographical Information System): Basic Principles, GIS Hardware & Software, Historical Development of GIS - Components of GIS, Data Representation, Data Capture, raster-vector formats, data conversion methods, Projections, Coordinate systems and registrations, Spatial analysis, Application of RS based GIS, Case study on GIS application in Water Resources projects and agriculture.	**3 Hrs**

Course Outcomes: The students will be able to	
CO1	Can acquire good knowledge about different procedure of map making and various projection system of map
CO2	Develop a broad knowledge about latitude, longitude,meridians, parallels etc.
CO3	Can prepare more accurateand précised map by applying different quantitative method
CO4	Demonstrate good cartographic technique regarding map layout and assess maps made by others
CO5	Can differentiate between GIS & Cartography

Process of Ascertaining(both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Two Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5thweek of the semester
2. Second test at the end of the 10thweek of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4thweek of the semester
2. Second assignment at the end of 9thweek of the semester

Group discussion / Activities /Seminar/ Quiz 05 Marks (duration 01 hours), and it is suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of two tests, two assignments, and Group discussion / Activities /Seminar/ Quiz will be for50 marks and shall be scaled for the same.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Text Book(s):	
1	Campbell, J.B. (2006). Introduction to Remote Sensing. 4th edn. Guilford Press.
2	P.R. Wolf: 2000 (2nd) Ed, Elements of Photogrammetry, McGraw Hill ins

Suggested Reference Book(s):	
1	Cracknell, A. (2007). Introduction to Remote Sensing 2nd. edn. Taylor and Francis.
2	Rampal, K.K., (2004), Textbook of Photogrammetry, John-Wiley & Sons
3	Lillesand T.M., Kiefer R.W. and Chipman J.W. (2003) Remote Sensing and Image Interpretation, 5th ed., Wiley.
4	Zorn H.C. (1980) Introductory Course in Photogrammetry, 6th Ed. ITC, Netherlands.

CO - PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓		✓	✓					✓
CO2	✓		✓	✓		✓	✓					✓
CO3	✓		✓			✓	✓					✓

Course Title	**DESIGN AND DRAWING OF RCC STRUCTURAL ELEMENTS**						
Course Code	**21CVT501**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: To understand the design philosophy & principles of working stress method and limit state method as per IS codal provisions, to solve the problems of RC structural elements subjected to torsion, flexure & shear and to design RC structural elements such as beams, columns, slabs, staircase and footings as per IS specifications.

UNIT – I **8 Hours**

GENERAL FEATURES OF REINFORCED CONCRETE:

Introduction, design loads, materials for reinforced Concrete and Code requirements. Design Philosophy – Working Stress method of Design concept, Limit State method of Design principles. Load factor, Characteristic and design loads, Characteristic and design strength. General aspects of Ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of singly reinforced rectangular sections, doubly reinforced rectangular sections and flanged sections. Ultimate shear strength & Ultimate torsional strength of RC sections, Concepts of development length and anchorage. Analysis of singly reinforced, doubly reinforced, flanged sections, shear strength and development length. General Specification for flexure design of beams. Practical requirements, size of beam, cover to reinforcements pacing of bars. General aspects of serviceability and deflection limits as in IS code.

UNIT – II **8 Hours**

DESIGN OF BEAMS:

Design procedures for critical sections for moment and shears. Anchorages of bars, check for development length. Reinforcement requirements, Slenderness limits for beams to ensure lateral stability. Design examples for Simply supported and Cantilever beams for Rectangular and Flanged sections.

UNIT – III **8 Hours**

DESIGN OF SLABS:

General considerations of design of Slabs, Rectangular slabs spanning in one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of Simply supported,Cantilever and Continuous slabs as per IS specifications.

UNIT – IV **8 Hours**

DESIGN OF COLUMNS AND FOOTINGS:

Design of Columns: General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity. Design of short axially loaded columns and column subjected to combined axial load and uni-axial moment and bi-axial moment using SP –16 charts.

Design of footings: Introduction, Proportioning of footing for equal settlement, Design basis for limit state method, Design of isolated rectangular footing for axial load and uni-axial moment. Design of pedestal.

UNIT – V **8 Hours**

DESIGN OF STAIR CASES:

General features, types of stair case, loads on stair cases, effective span as per IS, distribution ofloading on stairs. Design of stair cases, with waist slabs: Calculation of deflection (Theoretical method), Cracking in structural concrete members, Calculation of deflections and crack width.

Course Outcomes: The students will be able to	
CO1	Understand the concepts and principles of Limit state method & Working stress method to design RC structural elements.

CO2	Analyse the RC structural elements using limit state method for singly and doubly reinforced RC sections.
CO3	Design of RC structural elements such as beams, slab, columns, footings and staircase as per IS codal provisions.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Text Books:	
1	Design of Reinforced Concrete Structures- Krishnaraju N, 4th Edition, CBS Publishers and Distributors, New Delhi, 2017, eISBN 978-93-890-1701-4
2	Design of RCC Structural Elements – S. S. Bhavikatti, Vol-I, 3rd edition,New Age International Publications, New Delhi.
3	Design of Reinforced Concrete Structures- Unnikrishnan and Devadas Menon, 4thEdition, McGraw Hill, New Delhi, ISBN 978-9354601026.
4	Limit State Design of Reinforced Concrete- Varghese P.C, 2nd Edition, Eastern Economy Edition, Prentice –Hall of India Pvt Ltd, New Delhi, 2004, ISBN 9788120320390.
5	Fundamentals of Reinforced concrete Design-by M.L. Gambhir, PHI Learning Private Limited 2008-2009.
6	IS 456:2000, SP 16 Table, SP 34, IS 875 Part (I & II).

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓							✓		✓
CO2	✓	✓	✓									✓
CO3	✓	✓	✓							✓		✓

Course Title	**CONCRETE TECHNOLOGY**						
Course Code	**21CVT502**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**2**	**0**	**5**	**50**	**04**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To recognize material characterization of ingredients of concrete and its influence on properties of concrete. Understand proportion ingredients of concrete to arrive at most desirable mechanical properties of concrete. To ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

UNIT – I **8 Hours**

CEMENT AND AGGREGATES:

Introduction to Cement: Chemical Composition, Physical and Chemical properties, Hydration of Cement, Factors influencing and affecting hydration of cement & Types of cement.

Fine Aggregate: Grading, Analysis, Specify Gravity, Bulking, Moisture content.

Coarse Aggregate: Importance of Size, Shape and Texture. Grading of aggregates - Sieve analysis, Specific gravity, Flakiness and Elongation index, Crushing, Impact and Abrasion tests.

UNIT – II **10 Hours**

PROPERTIES OF FRESH AND HARDENED CONCRETE:

Manufacturing Process of Concrete: Batching, Mixing, Transporting, Placing, Compaction, Curing & Finishing.

Fresh Concrete: Workability – Definition and Requirements, Factors affecting workability, Measurement of workability – Slump test, Flow table test, Compaction factor test and Vee-Bee Consistometer tests, Segregation and Bleeding.

Hardened Concrete: Factors affecting strength, W/C ratio, Gel/Space ratio, Maturity concept, Destructive test on hardened concrete.

Admixtures: Types of admixtures and their effect on concrete property in fresh and hardened state. Plasticizers and superplasticizers, Retarders, Accelerators & Air-Entraining Admixtures.

UNIT – III **6 Hours**

Elasticity: Relation between modulus of elasticity and strength, Factors affecting modulus of elasticity, Poisson's ratio.

Shrinkage: Types of shrinkage, Factors affecting shrinkage.

Creep of Concrete: Measurement of creep, Factors influencing creep, Effects of creep.

UNIT – IV **8 Hours**

DURABILITY & PERMEABILITY OF CONCRETE:

Definitions, Causes, Short term and Long-term durability, Carbonation, Freezing and Thawing, Alkali – Aggregate reaction, Sulphate attack, Chloride attack, Acid attack, Effect of Sea water.

Special Concrete: Properties and Application of Self-Compacting Concrete, Light Weight Concrete, High Density Concrete, Fibre-Reinforced Concrete, Geo-Polymer Concrete & Ready Mix Concrete.

UNIT – V **8 Hours**

CONCEPT OF CONCRETE MIX DESIGN:

Mix Design Procedure: Concept of Concrete Mix design, Variables in proportioning, Exposure conditions, Procedure of mix design as per IS 10262-2019, Numerical examples of Mix Design.

Sl. No	Laboratory Experiments	No. of Sessions
1	Determination of Fineness of cement & Specific Gravity of cement.	10
2	Consistency test on cement and Compressive strength of cement.	
3	Determination of Setting times of cement.	
4	Determination of Soundness of cement.	
5	Measurement of workability of concrete by Slump cone test.	
6	Measurement of workability of concrete by Compaction factor test.	
7	Measurement of workability of concrete by Vee-bee Consistometer test.	
8	Tests for determination of Compressive strength of concrete.	
9	Tests for determination of Flexural strength of concrete.	
10	Tests for determination of Splitting tensile strength of concrete.	

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Assess and infer various properties of cement, fine and coarse aggregate as per Codal provision and specifications.
CO2	Understand the production of concrete, importance of curing, admixtures and properties of concrete in fresh and hardened state.
CO3	Acquires the knowledge about elasticity, durability and properties of special concrete.
CO4	Design the concrete for different grades as per IS: 10262-2019 provisions.
CO5	Examine and Evaluate properties of Cement and Concrete.

Text Books:	
1	M.S.Shetty, "Concrete Technology" - Theory and Practice, S.Chand and Company, New Delhi, 2002.
2	“Concrete Technology (Trade, Technology & Industry)”, George White, Delmar Cengage Learning, 1991.
3	“Concrete: Microstructure, Properties, and Materials”, P. Kumar Mehta, Paulo J. M. Monteiro, McGraw-Hill Education, 2017.
4	Neville, A.M., “Properties of Concrete", ELBS, London, Pearson Education India, 2012.
5	A.R.Santakumar, "Concrete Technology" –. Oxford University Press (2007)’
6	“Advanced Concrete Technology”, Zongjin Li, Wiley; 1 edition
7	Gambhir Dhanpat Rai & Sons , "Concrete Manual" -, New Delhi
8	N. Krishna Raju, "Concrete Mix Design" -, Sehgal - publishers
9	IS:10262-2016 , "Recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi
10	IS 456-2000, “Plain And Reinforced Concrete”, New Delhi.
11	Cement https://nptel.ac.in/courses/105102012/1 Aggregates https://nptel.ac.in/courses/105102012/6 Mineral admixtureshttps://nptel.ac.in/courses/105102012/11 Chemical admixtures https://nptel.ac.in/courses/105102012/9 https://nptel.ac.in/courses/105102012/10 Concrete mix design https://nptel.ac.in/courses/105102012/14 Concrete production & fresh concrete https://nptel.ac.in/courses/105102012/19

	Engineering properties of concretehttps://nptel.ac.in/courses/105102012/23 Dimensional stability & durability https://nptel.ac.in/courses/105102012/27 Durability of concrete https://nptel.ac.in/courses/105102012/31 Special concretes https://nptel.ac.in/courses/105102012/36

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓	✓	✓									
CO3	✓	✓		✓								
CO4	✓	✓	✓					✓				✓
CO5	✓	✓	✓						✓			✓

Course Title	**HIGHWAY ENGINEERING**						
Course Code	**21CVT503**						
Category	**Professional Core Course (PCC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To comprehend the knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development in INDIA. To understand the Highway planning and development considering the essential criteria's such as Engineering and financial aspects, regulations and policies, socio economic impact and the design consideration for drainage. To illustrate the different aspects of horizontal and vertical geometric elements for safe and efficient movement of vehicles. To evaluate pavement and its components, design aspects and its requirements to evaluate the highway economics by B/C, NPV, IRR methods.

UNIT – I **8 Hours**

PRINCIPLES OF TRANSPORTATION ENGINEERING:

Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.

HIGHWAY DEVELOPMENT AND PLANNING:

Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th twenty year road development plans and Policies, Present scenario of road development in India (NHAI, NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021**,** DPR of roads.

UNIT – II **8 Hours**

HIGHWAY ALIGNMENT AND SURVEYS:

Ideal Alignment, Factors affecting the alignment, Engineering surveys - Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.

HIGHWAY ECONOMICS:

Highway user benefits, VOC using charts only - Examples, Economic analysis - annual cost method, Benefit Cost Ratio method, NPV-IRR methods with Examples, Highway financing - BOT-BOOT concepts, Tender process.

UNIT – III **8 Hours**

HIGHWAY GEOMETRIC DESIGN:

Importance, Terrain classification, Design speed, Factors affecting geometric design, Cross sectional elements – Camber, width of pavement, Shoulders, Width of formation, Right of way with Typical cross sections. Sight Distance-Restrictions to sight distance, Stopping sight distance, Overtaking sight distance, overtaking zones- Examples on SSD and OSD with Sight distance at intersections.

Horizontal alignment - Radius of Curve, Super elevation, Extra widening, Transition curve and its length, setback distance – Examples on the said above.

Vertical alignment - Gradient-summit and valley curves with examples.

UNIT – IV **8 Hours**

PAVEMENT MATERIALS:

Subgrade soil - desirable properties - HRB soil classification, determination of CBR and modulus of subgrade reaction with Examples on CBR and Modulus of subgrade reaction.

Aggregates - Desirable properties and list of tests used in laboratory.

Bituminous materials - Bitumen, cutback and emulsion with List of tests on bituminous materials, PQC.

UNIT – V **8 Hours**

HIGHWAY DRAINAGE:

Significance and requirements, Surface drainage system and design - Examples, sub surface drainage system, design of filter materials with examples.

PAVEMENT DESIGN:

Pavement types, component parts of flexible and rigid pavements and their functions, design factors, Flexible pavement design as per IRC: 37 – 2018 and Design of rigid pavement as per IRC: 58 – 2015.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Understand the basic principles of transportation engineering and factors affecting highway alignment and economic analysis of various road projects.
CO2	Illustrate the factors which affects geometric design of highway with various properties and specifications of pavement materials used for road construction.
CO3	Apply the procedural knowledge for design, construction and maintenance of Flexible and pavement layers as per IRC codes.
CO4	Analyze the different types of drainage system in Highway Engineering.

Text Books:	
1	Highway Engineering–S K Khanna and C E G Justo, Nem Chand Bros, 10th Edition, Roorkee, 2011
2	Transportation Engineering, L. R. Kadiyali, Khanna Publishers, 1st edition, 2016
3	Highway Engineering, Karen K. Dixon and Paul H. Wright, Wiley, 7th edition, 2009.
4	Transportation Engineering, C. Jotin Khisty, B. Kent Lall, Pearson; 3rd edition, 2017
5	Highway Engineering, Martin Rogers, Bernard Enright, Wiley, 3rd edition, 2016.
6	Principles of Highway Engineering and Traffic Analysis, Fred L. Mannering, Walter P. Kilareski, Scott S. Washburn, Wiley, 3rd edition, 2007.
7	Pavement Analysis and Design, Yang Huang, Pearson, 2008.
8	Transportation Engineering and Planning, Papacostas, Pearson, Third edition, 2015.
9	A Policy on Geometric Design of Highways and Streets (Green Book), AASHTO, 2011 edition
10	Highway Engineering, Martin Rogers, Wiley-Blackwell, 2003
11	https://nptel.ac.in/courses/105105107 - NPTEL online course Video link
12	https://nptel.ac.in/courses/105101087 - NPTEL online course material link

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓										✓	
CO2	✓	✓										
CO3	✓		✓	✓								✓
CO4		✓		✓								

Course Title	**HYDROLOGY & IRRIGATION ENGINEERING**						
Course Code	**21CVT504**						
Category	**PROFESSIONAL CORE COURSE (PCC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To impart knowledge on the processes that secure the most valuable natural resource as water and it deals with the complex interaction and pathways of water connecting atmosphere, lithosphere and hydrosphere.

UNIT: I **08 hours**

ENGINEERING HYDROLOGY:

Introduction, Hydrologic Cycle, Water Budget Equation, World Water Balance, History of Hydrology, Applications in Engineering, Sources of Data.

PRECIPITATION:

Forms, Types, Characteristics, Measurement, Rain gauge Network, preparation and Presentation of Data, Mean Precipitation over an Area.

UNIT: II **08 hours**

LOSSES FROM PRECIPITATION:

Evaporation: Measurement, IS 5973: Pan evaporimeter, Meyer's formula, Reservoir Evaporation and Methods for its reduction.

Evapotranspiration: Measurement, Penman's equation.

Infiltration: Infiltration capacity, Measurement, Infiltration capacity values, Infiltration indices.

UNIT: III **08 hours**

Stream flow measurement: Floats and Current meter.

Runoff: Introduction, Base flow, Yield, Rainfall-Runoff Correlation, Khosla's formula, Flow-Mass curve.

Hydrographs: Factors affecting, Components of a Hydrograph, Base flow separation, Effective Rainfall, Unit hydrograph, Derivation of Unit hydrograph, Unit hydrographs for different durations.

UNIT: IV **08 hours**

IRRIGATION:

Introduction, Necessity, Scope, Benefits, Ill-effects of irrigation, Types, Methods, Factors affecting the choice of Irrigation methods, Classifications: Surface, Sprinkler and Sub-surface irrigation methods.

UNIT: V **08 hours**

WATER REQUIREMENT OF CROPS:

Limiting soil moisture condition, Depth of water applied during Irrigation and Frequency of Irrigation, Crop seasons and Crops of India, Crop period, Delta, Duty of water: Factors affecting and Methods of improving duty of water, Command areas and intensity of irrigation, Irrigation efficiencies and Irrigation requirements of crops.

Course Outcomes: The students will be able to	
1	Understand the basic concepts of hydrology and integrate the physical hydrological processes
2	Describe the various process, measurement and estimation of hydrological components: evaporation, infiltration, stream flow etc.
3	Estimate runoff and develop hydrograph to apply for engineering practices.
4	Estimate the quantity of water required by crops to plan and design irrigation projects.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.

- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

Text Books:	
1	Engineering Hydrology – Subramanya. K; Tata McGraw Hill New Delhi-2008 (Ed)
2	Hydrology- Madan Mohan Das, Mim Mohan Das-PHI Learning private Ltd. New Delhi-2009 (Ed)
3	Alternative Building Materials Technology -Jagadish, K.S., 2008, New Age International.
4	A Text Book Of Hydrology - Jayarami Reddy, Laksmi Publications, New Delhi-2007 (Ed)
5	Irrigation, water Resources and water power Engineering- P.N. Modi- standard book house, New Delhi.
6	Irrigation and Water Power Engineering - Madan Mohan Das & Mimi Das Saikia; PHI Learning pvt. Ltd. New Delhi 2009 (Ed).
7	Hydrology & Water Resources Engineering- R.K. Sharma & Sharma, Oxford and IBH, New Delhi
8	Irrigation Engineering and Hydraulic structures- S. K. Garg- Khanna Publication, New Delhi.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓					✓				✓	
CO2	✓											
CO3	✓		✓			✓			✓		✓	
CO3						✓			✓			

Course Title	**SOFTWARE APPLICATION LABORATORY**						
Course Code	**21CVL505**						
Category	**Professional Core Course Lab (PCCL)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	0	**0**	**2**	**0**	**2**	**25**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To attain skill sets to analyze structure using software. Learn the application of MS Excel to solve Civil Engineering problems.

UNIT – I **13 Hours**

Structural analysis software (STAAD)

Use of commercially available software for the analysis of

i) Simple beams.
ii) Continuous beams.
iii) 2D Portal frames-single storied and multi-storeyed.
iv) 3D frame analysis.
v) Analysis of trusses.
vi) Analysis of plates.

UNIT – II **12 Hours**

Applications of MS Excel in Civil Engineering problems

Use of spread sheet for the following Civil Engineering problems:

i) Design of singly reinforced and doubly reinforced rectangular beams.
ii) Design of one way and two way slabs.
iii) Design of isolated footing.
iv) Preparation of mix design as per IS 10262:2019.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to:	
CO1	Understand the applications of software in analysing different RC structural components.
CO2	Analyse trusses and plates using software.
CO3	Develop worksheets for different Civil Engineering problems using MS excel.

Text Books:

1	Learning Bentley Staad.Pro V8I for Structural Analysis – Sham Tickoo, Dreamtech Press New Delhi, ISBN-13 - 978-9351198093
2	Design of Reinforced Concrete Structures - Krishnaraju N and Pranesh. R.N, 2nd Edition, CBS Publishers and Distributors, New Delhi, 2003, ISBN 978-81-224-1460-8
3	IS 456:2000 - Plain and reinforced concrete - Code of practice
4	IS 10262:2019 - Concrete Mix Proportioning - Guidelines

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							✓
CO2	✓				✓							✓
CO3	✓				✓							✓

Course Title	**RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS**						
Course Code	**21HST506**						
Category	**ABILITY ENHANCEMENT COURSE (AEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	2	**0**	**0**	**0**	**2**	**40**	**02**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 02 hours**		

Course Learning Objective: To understand the meaning of engineering research and identifying the research problem and how to carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review. To explain the details of measurement and scaling techniques, different methods of data collections and also explain the art of interpretation and writing research reports and various forms of the intellectual property, its relevance and business impact.

UNIT – I **8 Hours**

INTRODUCTION:

Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving A Worthwhile Problem.

Defining The Research Problem: Research Problem, Selecting The Problem, Necessity of Defining The Problem, Technique Involved in Defining A Problem, An Illustration

Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

UNIT – II **8 Hours**

REVIEWING THE LITERATURE:

Place Of The Literature Review In Research, Bringing Clarity And Focus To Research Problem, Improving Research Methodology, Broadening Knowledge Base In Research Area, Enabling Contextual Findings, Review of The Literature, Searching The Existing Literature, Reviewing The Selected Literature, Developing A Theoretical Framework, Developing A Conceptual Framework, Writing About The Literature Reviewed.

Attributions And Citations: Giving Credit Wherever Due, Citations: Functions And Attributes, Impact of Title And Keywords on Citations, Knowledge Flow Through Citation, Citing Datasets, Styles For Citations, Acknowledgments and Attributions, What Should be Acknowledged, Acknowledgments In, Books Dissertations, Dedication or Acknowledgments.

UNIT – III **8 Hours**

DATA COLLECTION AND SOURCES:

Measurements, Measurement Scales, Questionnaires And Instruments, Sampling And Methods. Data - Preparing, Exploring, Examining, And Displaying.

UNIT – IV **8 Hours**

DATA ANALYSIS:

Overview of multivariate analysis, Hypotheses Testing And Measures of Association. Presenting Insights And Findings Using Written Reports And Oral Presentation.

UNIT – V **8 Hours**

INTERPRETATION AND REPORT WRITING:

Meaning of Interpretation, Technique of Interpretation, Precaution In Interpretation, Significance of Report Writing, Different Steps In Writing Report, Layout of The Research Report, Types of Reports, Oral Presentation, Mechanics of Writing A Research Report, Precautions For Writing Research Reports.

INTELLECTUAL PROPERTY:

The Concept, Intellectual Property System In India, Development of Trips Complied Regime In India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration And Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties And Farmers' Rights Act, 2001.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Understand the meaning of engineering research and identifying the research problem.
CO2	Understand the procedure of Literature Review and Technical Reading.
CO3	Describe the details of sampling designs, measurement and scaling techniques and also different methods of data collections.
CO4	Discuss the art of interpretation and the art of writing research reports and various forms of the intellectual property, its relevance and business impact.

Text Books:	
1	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018
2	Research Methodology a step-by step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications Ltd, 3rd Edition, 2011
3	David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488- 4

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓	✓	✓	✓								
CO4	✓											✓

Course Title	**ENVIRONMENTAL STUDIES**						
Course Code	**21CV507**						
Category	**HSSC**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective:

LO1- Understand the interdisciplinary nature of environmental studies and its importance in addressing global and local environmental challenges.

LO2- Comprehend the basic ecological principles, components of ecosystems, and the impacts of human activities on ecosystems and biodiversity.

LO3- Recognize the classification and sustainable management of natural resources, along with the sources and consequences of environmental pollution.

LO4- Gain knowledge of climate change, renewable energy sources, and their role in mitigating climate change, as well as understand the importance of environmental conservation and sustainable practices for a more sustainable future.

UNIT-I **3 Hours**

INTRODUCTION TO ENVIRONMENTAL STUDIES:

Definition and scope of environmental studies. Interdisciplinary nature of environmental studies. Environmental issues and challenges at the global and local levels. Importance of sustainable development and environmental conservation.

UNIT-II **3 Hours**

ECOLOGICAL CONCEPTS AND ECOSYSTEMS:

Basic ecological principles and concepts. Components of an ecosystem: biotic and abiotic factors. Ecological relationships and interactions**.** Human impacts on ecosystems and biodiversity loss

UNIT-III **3 Hours**

NATURAL RESOURCES AND ENVIRONMENTAL POLLUTION:

Classification and importance of natural resources (water, air, soil, minerals, forests, agricultural land, marine resources). Sustainable use and management of natural resources. Types and sources of environmental pollution (water, air, soil, noise). Impact of pollution on human health and the environment

UNIT-IV **3 Hours**

CLIMATE CHANGE AND RENEWABLE ENERGY:

Causes and consequences of climate change. Mitigation and adaptation strategies for climate change. Introduction to renewable energy sources (solar, wind, hydro, geothermal, biomass, hydrogen fuel). Role of renewable energy in combating climate change

UNIT-V **3 Hours**

ENVIRONMENTAL CONSERVATION AND SUSTAINABLE PRACTICES:

Biodiversity conservation and endangered species protection**.** Waste management and recycling practices**.** Sustainable agriculture and food systems. Environmental policies, regulations, and international agreements

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experiential learning.

Course Outcomes: The students will be able to	
CO1	Develop a comprehensive understanding of the interdisciplinary nature of environmental studies and its significance in addressing global and local environmental challenges.
CO2	Apply ecological principles and concepts to analyse and evaluate the components of ecosystems, as well as assess the impacts of human activities on ecosystems and biodiversity.
CO3	Demonstrate knowledge of the classification and sustainable management of natural resources, and evaluate the sources and consequences of environmental pollution.

CO4	Recognize the causes and consequences of climate change, identify renewable energy sources, and evaluate their role in mitigating climate change. Additionally, demonstrate an understanding of the importance of environmental conservation and sustainable practices for creating a more sustainable future.

Text Books and References	
1	R. Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005.
2	Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Universities Press (India) Private Limited, 2019.
3	Singh, J.S., Singh, S.P., and Gupta, S.R.). "Ecology, Environmental Science and Conservation". S. Chand Publishing, New Delhi, 2017.
4	D K Asthana, "Text Book of Environmental Studies", S Chand Publishing, 2010
5	Dr. J. P Sharma, "Environmental Studies", Laxmi Publications Pvt Ltd, 2017.
6	Benny Joseph, "Environmental Studies", Tata McGraw-Hill Publishing company Limited, 2008.
7	G.T.Miller Jr., "Environmental Science", 11th Edition, Cenage Learning Pvt. Ltd., 2008.
8	Singh, J.S., Singh, S.P., and Gupta, S.R.). "Ecology, Environmental Science and Conservation". S. Chand Publishing, New Delhi, 2017.
9	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
10	https://onlinecourses.nptel.ac.in/noc23_hs155/preview
11	https://nptel.ac.in/courses/122102006
12	http://nptel.ac.in/courses/122102006/7

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓	✓					✓
CO2	✓					✓	✓					✓
CO3	✓					✓	✓					✓
CO4	✓					✓	✓					✓

Course Title	**EXTENSIVE SURVEY PROJECT**						
Course Code	**21CVT5081**						
Category	**ABILITY ENHANCEMENT COURSE (AEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	0	**0**	**8**	**0**	**4**	**25**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To train & expose students to gain knowledge in Irrigation engineering, Highway engineering, Water supply and Sanitary Engineering; to locate suitable sites for New Tank Project, to exercise Restoration and Renovation of Old Tank to increase its storage capacity, To train for selection of suitable sites for construction of underground and overhead storage tanks.

General instructions, Reconnaissance of the sites and fly levelling to establish bench marks.	**1 Day**
NEW TANK PROJECTS: The work shall consist of i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line. ii) Capacity contours. iii) Details at Waste weir and sluice points. iv) Canal alignment.	**3 Day**
WATER SUPPLY AND SANITARY PROJECT: Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.	**2 Day**
HIGHWAY PROJECT: Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road**.**	**2 Day**
OLD TANK PROJECTS: The work shall consist of i) Alignment of center line of the existing bund, Longitudinal and cross sections of the centre line. ii) Capacity contours to explore the quantity. iii) Details at existing Waste weir and sluice points.	**2 Day**

Course Outcomes: The students will be able to	
CO1	Develop plans, maps and relative drawings for the construction and execution of Hydraulic structures such as New tank Project and Restoration of Old tanks.
CO2	Develop plans, maps and relative drawings for the construction of roads.
CO3	Develop plans, maps and relative drawings for the construction of water supply and sanitation structures.
CO4	Locate the centroid of plane and built-up sections and Compute the moment of inertia of plane and built-up sections.

Text Books:	
1	Surveying Vol–I and II– B.C. Punmia, Laxmi Publications, New Delhi.
2	Surveying Vol. I and II, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi
3	Surveying and Levelling – R Subramanian, Oxford University Press (2007)
4	Text Book of Surveying – C. Venkataramiah, Universities Press.(2009 Reprint)
5	Fundamentals of Surveying - Milton O. Schimidt – Wong, Thomson Learning.

6	Surveying , Arora
7	Maps by Survey of India.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓	✓				✓	✓		✓
CO2	✓	✓			✓				✓	✓		✓
CO3	✓	✓	✓	✓			✓		✓	✓		✓
CO4	✓	✓		✓	✓				✓	✓		✓

Course Title	**DETAILING OF REINFORCED CONCRETE STRUCTURES**						
Course Code	**21CVT5082**						
Category	**ABILITY ENHANCEMENT COURSE (AEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 01 hours**		

Course Learning Objective: Understanding various codes of RC structural design viz IS 456, SP-16, SP-34, and apply the knowledge in detailing of various structural RC elements. Impart the usage of codes for detailing of Retaining Wall and Water tanks.

UNIT – I	**3 Hours**
Introduction to Detailing of RC structures codes: IS 456 2000, Sp-16, SP-34 for slabs, beams, columns and footing elements	
UNIT – II	**3 Hours**
Detailing of Continuous beams and Slabs. Arrangement of bars, Longitudinal reinforcement, shear reinforcement detailing, torsional reinforcement, curtailment of reinforcement. Solid slabs, Minimum reinforcement, space , cover, diameter, simply supported slabs, cantilever slabs	
UNIT – III	**3 Hours**
Detailing of Columns and Footings. Longitudinal reinforcement, transverse reinforcement. Types of foundation, minimum reinforcement, isolated and combined footing	
UNIT – IV	**3 Hours**
Detailing of Retaining walls. Cantilever and counterfort retaining wall	
UNIT – V	**3 Hours**
Detailing of water tanks. Rectangular and circular Tanks	

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

References

1	Unnikrishnan Pillai and Devdas Menon, " Reinforced Concrete Design" , McGraw Hill, New Delhi
2	Subramanian, " Design of Concrete Structures" , Oxford university Press
3	H J Shah, "Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)", Charotar Publishing House Pvt. Ltd.
4	P C Varghese, "Limit State design of reinforced concrete", PHI, New Delhi. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.
5	W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publishers.
6	Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications.
7	A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press.
8	IS 456 2000 Plain and reinforced concrete code of Practice
9	Sp-16 Design aids for Reinforced concrete to IS 456:2000
10	IS 13920: Ductile Detailing of Reinforced concrete Structure subjected to seismic force-Code of Practice
11	IS 1893 (part-1) Criteria for Earthquake Resistant Design of Structures
12	SP-34 Handbook on concrete reinforcement and detailing
13	IS 3370 Part 4 code of practice for concrete structures for the storage

Course Outcomes: The students will be able to	
CO1	Understand the detailing of various RC structural elements in relevance with Codal guidelines.
CO2	Demonstrate the procedural knowledge in detailing of RC structural elements such as slabs, beams columns and footings.
CO3	Apply the knowledge in detailing of RC structural elements such as retaining walls and water tanks.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓						✓
CO2	✓	✓				✓						✓
CO3	✓	✓	✓			✓						✓

Course Title	**HAZARDOUS WASTE MANAGEMENT**						
Course Code	**21CVT5083**						
Category	**ABILITY ENHANCEMENT COURSE – V (AEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 02 hours**		

Course Learning Objective: Understand the type, nature and treatment of hazardous wastes. Define, identify source and classify hazardous waste Handle and manage the Nuclear and Biomedical waste for its disposal Handle and manage the E-waste and Plastic waste for its disposal.

UNIT – I **3 Hours**

INTRODUCTION TO HAZARDOUS WASTE:

Hazardous waste definition, sources, identification and classification; Hazardous waste management in developing countries- TSDF concept; Hazardous waste management rules and regulations

UNIT – II **3 Hours**

HAZARDOUS WASTE TREATMENT AND DISPOSAL:

Hazardous waste treatment technologies: Physical, chemical, physico-chemical treatment, and thermal treatment;-Solidification, chemical fixation, encapsulation, pyrolysis and incineration. Hazardous waste disposal: Hazardous waste landfills- Site selections. Hazardous waste reduction, recycling and reuse, List of remediation for hazardous waste contaminated sites.

UNIT – III **3 Hours**

MANAGEMENT OF NUCLEAR WASTE AND BIOMEDICAL WASTE:

Characteristics – Types – Nuclear waste – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel – Management of nuclear wastes – Decommissioning of Nuclear power reactors – Health and environmental effects. Introduction to biomedical wastes, sources, classification, collection, segregation, treatment and disposal. Biomedical waste management rules.

UNIT – IV **3 Hours**

MANAGEMENT OF PLASTIC WASTE:

Plastic Waste – Sources, Production, Global and Indian Context; Plastic Waste Management Practices – Plastic management- recycling, energy production, landfilling, other application.

UNIT – V **3 Hours**

MANAGEMENT OF E-WASTE:

E-waste characteristics; e-waste generation, collection, transport, recycling and disposal methods; Effects of e-wastes on the society and environment. E-waste waste management rules

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Understanding physical, chemical and biological characteristics of hazardous wastes.
CO2	Analyse activities associated with the management of Hazardous wastes.
CO3	Formulate and plan suitable treatment and disposal facility for handling hazardous wastes.
CO4	Manage handling of plastic waste and E waste disposal.

Text Books:	
1	Waste Management Practices: Municipal, Hazardous and Industrial, John Pichtel, CRC Press, 2014, 2nd Edition
2	Hazardous Waste Management, LaGrega M.D., Buckingham P.L. and Evans J.C., Waveland Pr Inc., 2010, Reissue Edition
3	Integrated Solid Waste Management, Engineering Principles and Management Issues, Tchobanoglous

	G, Theisen H and Vigil SA, McGraw Hill Education, 2014, Indian Edition
4	Handbook of Solid Waste Management, Tchobanoglous G and Kreith F, McGraw-Hill Education, 2002, 2nd Edition
5	Geotechnical Aspects of Landfill Design and Construction, Qian X, Koerner R M and Gray D H, Prentice Hall, 2002, 1st Edition
6	Hazardous Wastes - Sources, Pathways, Receptors, Richard J. Watts, John Wiley and Sons, 1998, 1st Edition.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓	✓	✓		
CO2	✓	✓			✓	✓		✓				
CO3	✓		✓	✓			✓		✓		✓	
CO4	✓					✓		✓	✓		✓	

Course Title	**HIGHWAY GEOMETRIC DESIGN**						
Course Code	**21CVT5084**						
Category	**ABILITY ENHANCEMENT COURSE (AEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	1	**0**	**0**	**0**	**1**	**15**	**01**
CIE Marks:50	**SEE Marks: 50**		**Total Max. Marks: 50**		**Duration of SEE: 02 hours**		

Course Learning Objective: To explain the various cross sectional elements and the geometrical control factors related to design of highway Geometrics, to understand the basic knowledge of sight distance requirement in the design of roads as per IRC and AASHO standards and to apply the procedural knowledge of horizontal and vertical alignment related to highway geometrics with Standard design specifications.

UNIT – I **3 Hours**

INTRODUCTION:

Geometric Control factors like Topography, design speed, design vehicle, Traffic – Capacity, volume, environment and other factors as per IRC and AASHTO standards and specifications. PCU concept – factors controlling PCU for different design purpose.

UNIT – II **3 Hours**

CROSS SECTIONAL ELEMENTS:

Pavement surface characteristics – friction, skid resistance, pavement unevenness, light reflecting characteristics. Camber – objectives, types of camber.

Carriage way – kerb, median, shoulder, foot path, parking lanes, service roads, cycle tracks, Driveways. Right of way.

UNIT – III **3 Hours**

SIGHT DISTANCE:

Importance, types, Sight distance, factors affecting sight distance as per IRC, AASHTO standards, Numericals.

UNIT – IV **3 Hours**

HORIZONTAL ALIGNMENT:

Definition, Super elevation, Ruling minimum and maximum radius, Assumptions, Extra widening of pavement on curves – objectives, types ,Mechanical widening – psychological widening – Transition curve – objectives – Ideal requirements – Types of transition curve – Method of evaluating length of transition curve .

UNIT – V **3 Hours**

VERTICAL ALIGNMENT:

Gradient – Types of gradient – Design criteria of summit and valley curve. Design of vertical curves based on SSD and OSD.

Teaching & Learning Process:	Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Text Books:	
1	Principle and practice of Highway Engineering - L R KADIYALI & N B LAL: Khanna publications, 2017 edition, New Delhi.
2	Highway Engineering – Khanna S K & Justo, Publishers - Nemchand & Bros-1990, 10th edition.
3	Highway Engineering by R Srinivas Kumar, Publishers - Orient Blackswan Private Limited - New Delhi. Publication date-1 January 2011.
4	Highway Engineering- Dr. L. R. Kadiyali , Publisher-Khanna Publishing, 2016
5	Relevant IRC:38- Horizontal curve; IRC:23-Vertical curve
6	Transportation Engineering and Planning- Papacostas, Publisher-Prentice Hall India Learning Private Limited; 3rd edition

Course Outcomes: The students will be able to	
CO1	Understand the geometrical control factors and the various cross sectional elements related to design of highway geometrics.
CO2	Illustrate the types of sight distance, factors affecting the sight distance under specific condition as per IRC and AASHO standard.
CO3	Design the horizontal and vertical alignment related to highway geometrics with standard design Specifications.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓	✓										✓
CO3	✓	✓	✓									✓

Course Title	**CONSTRUCTION PROJECT AND MANAGEMENT**						
Course Code	**21CVT601**						
Category	**Humanity and Social Science Course (HSSC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: The course will enable students to understand the concept of planning, scheduling, cost and quality control, safety during construction, organization & use of project information necessary for construction project and inculcate Human values to grow as responsible human beings with proper personality, keeping up ethical conduct and discharge professional duties.

UNIT – I **8 Hours**

MANAGEMENT:

Characteristics of management, functions of management, importance and purpose of planning process, types of plans.

CONSTRUCTION PROJECT FORMULATION:

Introduction to construction management, project organization, management functions, management styles.

UNIT – II **8 Hours**

CONSTRUCTION PLANNING AND SCHEDULING:

Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path- critical path method, PERT method, concept of activity on arrow and activity on node.

UNIT – III **8 Hours**

RESOURCE MANAGEMENT:

Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

CONSTRUCTION QUALITY AND SAFETY:

Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management

UNIT – IV **8 Hours**

HEALTH SAFETY AND ENVIRONMENT (HSE):

Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances.

Materials: Material management functions, inventory management.

UNIT – V **8 Hours**

ETHICS & AND HUMAN VALUES:

Morals, values and ethics, integrity, trustworthiness, work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.

INTRODUCTION TO ENGINEERING ECONOMY:

Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to

CO1	Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence.

CO2	Understand labour output, equipment efficiency to allocate resources required for an activity/project to achieve desired quality and safety.
CO3	Analyse the economics of alternatives and evaluate benefits and profits of a construction activity based on monetary value and time value.
CO4	Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.

Text Books:	
1	Tripathi, P. C., and P. N. Reddy. "Principals of Management 5th edition" (2012).
2	Chitkara, K. K. “Construction project management” Tata McGraw-Hill Education, 1998.
3	Choudhury, Sadhan. “Project management” Mc Graw Hill Education, 2019.
4	Seetharaman, S. “Construction Engineering and Management” Umesh Publications, 2014.
5	Srinath, Laxmipuram Srimivasacher. “PERT and CPM: Principles and Applications” Affiliated East-West Press, 1975.
6	Charantimath, Poornima M. “Entrepreneurship Development and Small business enterprises” Pearson Education India, 2013.
7	Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
8	Clough, Richard H., Glenn A. Sears, and S. Keoki Sears. “Construction project management” John Wiley & Sons, 2000.
9	Walker, Anthony. “Project management in construction” John Wiley & Sons, 2015.
10	Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, NewDelhi

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓										✓	
CO2	✓									✓	✓	
CO3		✓				✓		✓			✓	
CO4								✓				✓

Course Title	**GEOTECHNICAL ENGINEERING**						
Course Code	**21CVT602**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**2**	**0**	**5**	**50**	**04**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To understand the importance of soil and its properties in Civil Engineering applications. To demonstrate the index properties and engineering properties of different soils. To interpret the various factors influencing the soil behavior. To summarize the significance of soils and its behavior in various applications of Civil Engineering.

UNIT – I **8 Hours**

SOIL IN ENGINEERING PRACTICE:

Phase representation diagram, Basic definitions of terms - Voids ratio, Porosity, Air content, Degree of saturation, Percentage Air Voids, Water content, Specific Gravity of soil solids and soil mass, Unit weights - Dry, Bulk, Saturated and Submerged and their inter relationships. Numericals.

INDEX PROPERTIES OF SOIL AND THEIR DETERMINATION:

Water content, Specific gravity of soil solids, Particle size distribution, In-situ density, Relative Density, Consistency limits. Numericals.

UNIT – II **8 Hours**

CLASSIFICATION SYSTEM OF SOILS:

Field identification of soils, IS Soil classification, IS Plasticity chart. Numericals.

PERMEABILITY:

Darcy's law - assumption and validity, Seepage velocity, Discharge velocity and coefficient of percolation. Factors affecting permeability, Coefficient of permeability and its determination - laboratory and field. Numericals.

UNIT – III **8 Hours**

GEO-STATIC STRESS CONCEPTS:

Concept of effective stress under different conditions of soils (Submerged soil mass with water table Above and At the ground surface, Partially submerged, Surcharge and soil mass with Capillary rise), Stresses affected by direction of flow of water (Upward and downward), Quick sand phenomena. Numericals.

SEEPAGE ANALYSIS:

Flow nets – characteristics and applications, Flow nets for sheet piles and below dam. Phreatic line – A. Casagrande's method – with and without filter, Pipe failure, Heave failure, Design of dam filters. Numericals.

UNIT – IV **8 Hours**

COMPACTION OF SOIL:

Standard Proctor's compaction test, Factors affecting compaction, Effect of compaction on Engineering properties of soil, Field compaction control, Proctor's needle, Compacting equipments and their suitability. Numericals.

CONSOLIDATION OF SOIL:

Terzaghi's Mass - Spring analogy, Terzaghi's one dimensional consolidation theory assumption and limitations, Pre-consolidation pressure and its estimation by A. Casagrande's method. Laboratory one dimensional consolidation test, Determination of consolidation characteristics of soils - Compression index and Coefficient of consolidation. Numericals.

UNIT – V **8 Hours**

SHEAR STRENGTH OF SOIL:

Concept of shear strength, Mohr's - Coulomb's theory, Terzaghi's total and effective stress principle, Classification of shear tests based on drainage conditions and simulate their field conditions, Measurement of shear strength parameters: Direct shear box test, Tri-axial compression test, Unconfined compression test and Vane shear test. Numericals.

Expt. No	LABORATORY EXPERIMENTS:	No. of sessions
1	Tests for determination of Specific gravity.	10
2	Tests for determination of Water content.	
3	Sieve analysis.	
4	Core cutter and Sand replacement methods.	
5	Consistency Limits – Liquid Limit, Plastic limit and Shrinkage limit.	
6	Standard Proctor Compaction Test and Modified Proctor Compaction Test.	
7	Relative density of sand.	
8	Constant head and variable head permeability Test.	
9	Direct Shear Box Test.	
10	Unconfined Compression Test.	
	Demonstrations: ✓ Equipments such as Augers, Samplers, Rapid Moisture meter, Proctor's needle. ✓ Free Swell Index, Differential free swell test. ✓ Consolidation Test - Determination of compression index and coefficient of consolidation. ✓ Hydrometer analysis ✓ Vane shear test. ✓ Tri-axial Compression Test.	

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: At the end of the course the student will be able to:	
CO1	Understand the index properties of soils and analyse the data to identify and classify the soils.
CO2	Discuss the permeability, effective stresses and seepage in soils.
CO3	Explain the concepts and evaluate compressible characteristics and shear strength parameters of soil.

Text Books:	
1	"Soil Mechanics and Foundation Engineering", Punmia B. C. and Jain A. K. (2005), 17th Edition Laxmi Publications Co., New Delhi.
2	"Soil Mechanics and Foundation Engineering (Geotechnical Engineering): In SI Units", Arora, K. R. (2008), 7th Edition, Standard publishers. New Delhi.
3	"Basic and Applied Soil Mechanics", Ranjan G. and Rao A.S.R. (2011), New Age International (P) Ltd., New Delhi.
4	"Geotechnical Engineering", Braja, M. Das (2002), 5th Edition, Thomson Business Information India (P) Ltd., India
5	"Principles of Soil Mechanics and Foundation Engineering", Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.

6	"Foundation analysis and design", Bowles J. E. (1988), 5th Edition, McGraw- Hill Publications. New Delhi.
7	"Manual of Soil Laboratory Testing", Head K.H., (2006), 3rd Edition, Vol. I, II, III, Princeton Press, London.
8	BIS Codes of Practice: IS: 2720(Part-3/Sec. 1) – 2002; IS: 2720 (Part – 2)- 2010; IS: 2720 (Part – 4) – 2006; IS: 2720 (Part – 5) – 2006; IS: 2720 (Part – 6) – 2001; IS: 2720 (Part – 7) – 2011; IS: 2720 (Part – 8) – 2006; IS: 2720 (Part – 17) – 2002; IS: 2720 (Part - 10) – 2006; IS: 2720 (Part – 13) – 2002; IS: 2720 (Part 11) – 2002; IS: 2720 (Part 15) – 2002; IS: 2720 (Part 30) – 2007; IS: 2720 (Part 14) – 1977; IS: 2720 (Part – 14) –2006; IS: 2720 (Part – 28) – 2010; IS: 2720 (Part – 29) – 2005.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2	✓	✓		✓								✓
CO3	✓	✓		✓								✓

Course Title	**DESIGN OF STEEL STRUCTURES**						
Course Code	**21CVT603**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objective: To know different terminologies related to steel design and construction in accordance with the latest codes, to study limit state concept of steel design and detailing, to understand design of members under axial loads like tension, compression and flexural loads and To acknowledge design of Column bases, simple and gusseted base connections.

UNIT – I **8 Hours**

INTRODUCTION:

Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel, Codes, Specifications and section classification.

BOLTED CONNECTIONS:

Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Pin Connections, Simple Connections,Moment resistant connections, Beam to Beam connections, Beam and Column splices, Semi rigid connections.

UNIT – II **8 Hours**

WELDED CONNECTIONS:

Introduction, Welding process, Welding electrodes, Advantages of Welding, Types andProperties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections, Continuous Beam to Column connections, Continuous Beam to Beam connections, Beam Column splices.

UNIT – III **8 Hours**

DESIGN OF TENSION MEMBERS:

Introduction, Types of tension members, Design of strands, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members,Angles under tension, other sections, Design of tension member, Lug angles, Splices, Gussets.

DESIGN OF COMPRESSION MEMBERS:

Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, Built up compression members.

UNIT – IV **8 Hours**

DESIGN OF COLUMN BASES:

Design of simple slab base and gusseted base.

DESIGN OF BEAMS:

Introduction, Beam types, Lateral stability of beams, factors affecting lateral stability, Behaviour of simple and built-up beams in bending(without vertical stiffeners), Designstrength of laterally supported beams in Bending, Design strength of laterally unsupported beams, Shear strength of steel beams, Maximum deflection, Design of beams and purlins.

UNIT – V **8 Hours**

PLASTIC BEHAVIOUR OF STRUCTURAL STEEL:

Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, conditions of plasticanalysis,

Theorems of Plastic Analysis, Methods of Plastic analysis, Plastic analysis of continuous beams and Portal frames.

Text Books:	
1	K.S. Sai Ram, Design of Steel Structures, Pearson Publishers.
2	Dr. Ramachandra and Virendra Gehlot, Design of Steel Structures 1&2, SCIENTIFIC (INDIA). Publishers.
3	N. Subramanian, Design of Steel Structures (Limit state Design), Oxford Publishers.
4	Dr. Anand S. Arya & Dr. J.L. Ajmani, Design of Steel Structures, printed by N.C Jain, Roorkee press, Roorkee.
5	IS: 800, IS: 875 and Steel tables.
6	Design of Steel Structures, N. Subramanian, Oxford, 2008.
7	Limit State Design of Steel Structures, S.K Duggal. TATA Mc Graw Hill 2010.
8	Design of Steel Structures - Negi - Tata Mc Graw Hill Publishers.
9	Design of Steel Structures - Arya and Ajaman- Nem Chand & Bros. Roorkee.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The Students will be able to	
CO1	Understand the contemporary methodologies, specifications, loads, sections/shapes and current codes are used in the analysis and design of steel structural elements.
CO2	Discuss the fundamental principles & design of Welded & Bolted connections.
CO3	Design of tension, compression members column bases & Beams.
CO4	Assess the Plastic behavior, failure modes, safety & serviceability of structural steel.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓	✓	✓									✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓									✓

Course Title	**Computer Aided Drawing of RC & Steel Structures**						
Course Code	**21CVL606**						
Category	**Professional Core Course Lab (PCCL)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	0	**0**	**2**	**0**	**2**	**25**	**01**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To prepare the layout drawing for any kind of structure. Understand the estimation of reinforcement quantity for various structural elements. Learn to prepare connections drawing for various structural steel members.

UNIT – I **10 Hours**

DETAILING OF RC STRUCTURAL ELEMENTS:

(i) Layout drawing: Preparation of general layout of building showing, position of columns, footings, beam & slab with standard notations.
(ii) RCC Column Footing (isolated and combined)
(iii) Dog legged and open well staircase
(iv) Slabs – One way and Two way slabs
(v) Beams – Singly and doubly reinforced beams

BAR BENDING SCHEDULE:

Preparation of Bar bending schedule for various structural elements like beam, column, footing and slab.

UNIT – II **15 Hours**

CONNECTIONS:

Bolted and welded connections.
Beam to Beam, Beam to Column, Seated, Stiffened and Un-stiffened connections.

COLUMNS:

Splices, Column to Column connection of same and different sections.
Lacing and Battens.

COLUMN BASES:

Slab base and Gusseted base.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos.

Course Outcomes: The students will be able to	
CO1	Understand the detailing of RC structural elements.
CO2	Estimate steel quantity for various structural elements.
CO3	Develop connection details of various steel section.

Text Books:	
1	Building Planning and Drawing, S.S. Bhavikatti, M.V. Chitawadagi, Dreamtech Press, New Delhi, ISBN-13 978-9389307085
2	Limit State Design of Steel Structures, S.K Duggal. Mc Graw Hill Publications.
3	IS 800:2007 – General construction in steel — Code of practice
4	SP: 6 – Handbook for structural engineers. (Structural Steel Sections)
5	SP:7 – National Building Code of India
6	SP:34 – Handbook on Concrete Reinforcement Detailing

Question paper pattern:

One question each from Unit-I & Unit-II.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							✓
CO2	✓				✓							✓
CO3	✓				✓							✓

Course Title	**MATRIX METHOD OF STRUCTURAL ANALYSIS**						
Course Code	**21CVTE6041**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To Gain basic knowledge of structural systems and application of concepts of flexibility and stiffness matrices for simple elements, understand flexibility and stiffness matrices to solve problems in beams, frames and trusses, Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses and Gain knowledge of solving problems involving temperature changes and lack of fit.

UNIT – I **8 Hours**

INTRODUCTION:

Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements. Force transformation matrix, global flexibility matrix. Displacement transformation matrix, global stiffness matrix

UNIT – II **8 Hours**

ANALYSIS OF CONTINUOUS BEAMS:

Using element stiffness method and flexibility method. Effects of Temperature Changes and Lack of Fit.

UNIT – III **8 Hours**

ANALYSIS OF RIGID FRAMES:

Using element stiffness method and flexibility method. Effects of Temperature Changes and Lack of Fit.

UNIT – IV **8 Hours**

ANALYSIS OF TRUSSES:

Using element stiffness method and flexibility method. Effects of Temperature Changes and Lack of Fit.

UNIT – V **8 Hours**

DIRECT STIFFNESS METHOD:

Local and global coordinates systems, principle of contra gradience, global stiffness matrices of beam and truss elements, analysis of continuous beams and trusses.

Teaching Learning Process:

Chalk and talk, Power point Presentation, Video, Quiz/Assignments/Open book test to develop skills.

Text Books:

1	Weaver W and Gere J H, “Matrix Analysis of Framed Structures”, CBS publications, New Delhi.
2	Rajasekaran S, “Computational Structural Mechanics”, PHI, New Delhi.
3	Madhujit Mukhopadhay and Abdul Hamid Sheikh, “Matrix and Finite Element Analysis of Structures”, Ane Books Pvt. Ltd
4	P N et.al, “Matrix Method of Structural Analysis”, PHI ltd, New Delhi.
5	Pundit and Gupta, “Theory of Structures Vol II”, TMH publications, New Delhi
6	A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee.
7	Manikaselvam, “Elements of Matrix Analysis and Stability of Structures”, Khanna Publishers, New Delhi.
8	H C Martin, “Introduction to Matrix Methods in Structural Analysis”, International textbook company, McGraw Hill

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

CO1	Evaluate the structural systems to application of concepts of flexibility and stiffness matrices for

	simple problems.
CO2	Identify, formulate and solve engineering problems with respect to flexibility method as applied to continuous beams, rigid frames and trusses.
CO3	Formulate and solve engineering problems by application of concepts of direct stiffness method as applied to continuous beams and trusses.
CO4	Evaluate Temperature stresses and lack of fit problems sing matrix method.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓	✓	✓								
CO3	✓	✓	✓	✓								
CO4	✓	✓	✓	✓								

Course Title	**Solid Waste Management**						
Course Code	**21CVTE6042**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: Understand the key principles and concepts of integrated solid waste management (ISWM), including waste generation, collection, treatment, and disposal. Analyze and evaluate different waste management strategies and technologies, considering their environmental, health impacts. Apply practical knowledge of waste reduction, recycling, composting, and energy recovery techniques to develop sustainable waste management plans. Demonstrate the ability to develop and implement comprehensive ISWM plans that align with regulatory requirements, community needs, and sustainability goals.

UNIT – I **8 Hours**

INTRODUCTION AND WASTE GENERATION ASPECTS:

Sources, types, functional elements of solid waste management, factors affecting solid waste generation and management, waste characteristics, health and environmental effects. Numerical on moisture content, density and energy content.

UNIT – II **8 Hours**

WASTE PROCESSING TECHNIQUES:

Purpose of processing, volume and size reduction, component separation, significance of source reduction, product recovery and recycling, planning of a recycling programme, recycling programme elements, commonly recycled materials and processes.

COLLECTION, STORAGE, TRANSPORT OF WASTES:

Collection components, storage-containers/collection vehicles, collection operation and route optimization, need and types of transfer stations, location of transfer station. Estimation of solid waste quantities.

UNIT – III **8 Hours**

BIOLOGICAL CONVERSION TECHNOLOGIES:

Definition of compost, classification of composting, key process variables of composting, different types of composting- aerobic composting, windrow composting, in-vessel composting, aerated static pile composting, vermicomposting, anaerobic composting. Site selection and design of composting. Specifications for composting as per Solid Waste Management Rules-2016.

THERMAL CONVERSION TECHNOLOGIES:

Definition of thermal process, categories of thermal conversion, Combustion Systems-Mass fired combustion systems, RDF-Fired combustion system, Fluidized bed combustion. Pyrolysis Systems, Gasification Systems. Environmental and air pollution control systems. Air Quality standards as per Solid Waste Management Rules-2016.

UNIT – IV **8 Hours**

DISPOSAL OF SOLID WASTES:

Sanitary landfills- Definition, environmental impact and its minimization, Landfilling methods-trench method, area method and canyon method. Essential components, site selection, landfill planning and design factors. Generation, movement and control of landfill gases. Formation, movement and control of leachate. Different types of Liner systems. Landfill closure and post closure care. Numerical on landfill area estimation. Specifications for Sanitary Landfills as per Solid Waste Management Rules-2016.

UNIT – V **8 Hours**

SPECIAL WASTE MANAGEMENT:

Definition, importance of special waste Management, Automotive Wastes, Construction and Demolition Wastes, Electronic Wastes, Industrial Solid Wastes, Medical Wastes, Plastic Wastes, Lead Battery Wastes

(environmental significance, recovery, recycle and current management systems). Waste Management Laws in India.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos and waste collection and disposal site visit.

Course Outcomes: The students will be able to	
CO1	Narrate the basics of solid waste management towards sustainable development.
CO2	Apply technologies to process waste for product and energy recovery options.
CO3	Comprehend the principles and practices involved in the safe and environmentally sound disposal Technique.
CO4	Analyze the need for special wastes management for safe and sustainable disposal.

Text Books and References	
1	Ramesha Chandrappa and Diganta Bhusan Das "Solid Waste Management: Principles and Practice", Springer Berlin Heidelberg, 2012.
2	George Tchobanoglous, Hilary Theisen, Samuel Vigil, "Integrated Solid Waste Management: Engineering Principles and Management Issues", McGraw-Hill Companies, Incorporated, 1993.
3	William A. Worrell and P. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning Inc, 2012.
4	Dr. R.Saravanan, "Municipal Solid Waste Management", Suchitra Publications, 2017.
5	P. White, M. Franke, P. Hindle "Integrated Solid Waste Management: A Lifecycle Inventory", 1995.
6	Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, "Environmental Engineering", McGraw Hill International Editions, 1985.
7	Sunil Kumar, "Municipal Solid Waste Management in Developing Countries", CRC Press, 2016.
8	Sunil Kumar, "Municipal Solid Waste Management in Developing Countries", CRC Press, 2016.
9	George Tchobanoglous and Frank Kreith, "Handbook of Solid Waste Management", 2nd Edition, The McGraw-Hill Companies, Inc., 2002.
10	https://onlinecourses.nptel.ac.in/noc19_ce31/preview
11	https://archive.nptel.ac.in/courses/105/103/105103205/
12	https://www.digimat.in/nptel/courses/video/105102160/L06.html

Question paper pattern:
• The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of three sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓										✓
CO3	✓			✓								✓
CO4	✓						✓					✓

Course Title	**ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES**						
Course Code	**21CVTE6043**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To understand environmental issues due to building materials and the energy consumption inmanufacturing building materials, to study the various masonry blocks, masonry mortar and structural behavior of masonry under compression, to study the alternative building materials in the present context and to understand the alternative building technologies which are followed in present construction field.

UNIT – I **8 Hours**

INTRODUCTION:

Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry. Environmental friendly and cost effective building technologies. Requirements for building of different climatic regions. Traditional building methods and vernacular architecture

UNIT – II **8 Hours**

ALTERNATIVE BUILDING MATERIALS:

LIME-POZZOLANA CEMENTS: Raw materials, Manufacturing process, Properties and uses, Fiber reinforced concretes, Matrix materials, Fibers: metal and synthetic, Properties and applications, Fiber reinforced plastics, Fibers: organic and synthetic, Properties and applications, Building materials from agro and industrial wastes, Types of agro wastes,

Types of industrial and mine wastes, Properties and applications Field quality control test methods.

UNIT – III **8 Hours**

ALTERNATIVE BUILDING TECHNOLOGIES:

Alternative for wall construction, Types, Construction method, Masonry mortars, Types, Preparation, Properties, Ferro cement and Ferro concrete building components.

Materials and specifications, Properties, Construction methods, Applications Alternative roofing systems, Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

UNIT – IV **8 Hours**

STRUCTURAL MASONRY:

Compressive strength of masonry elements, Factors affecting compressive strength.Strength of units, prisms/wallettes and walls, Effect of brick work bond on strength,

Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry. IS Code provisions, Design of masonry, compression elements and Concepts in lateralload resistance

UNIT – V **8 Hours**

COST EFFECTIVE BUILDING DESIGN:

Cost concepts in buildings, Cost saving techniques in planning, design and construction.

EQUIPMENT FOR PRODUCTION OF ALTERNATIVE MATERIALS:

Machines for manufacture of concrete, Equipment for production of stabilized blocks, Moulds and methods of production of precast element

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and waste collection and disposal site visit.

Course Outcomes: The students will be able to	
CO1	Understand the need for Alternative Building Materials in Construction industry.
CO2	Interpret the properties of mortar and other alternative construction materials.

CO3	Design Masonry walls, adopt cost effective materials and cost saving techniques.

Text Books and References	
1	Alternative building methodologies for engineers and architects, lecture notes edited: K.S. Jagadishand B.V. Venkatarama Reddy, Indian Institute of Science, Bangalore.
2	Structural Masonry- Henry, A.W: Macmillan Education Ltd., 1990.
3	Alternative building methodologies for engineers and architects, lecture notes edited: K.S. Jagadishand B.V. Venkatarama Reddy, Indian Institute of Science, Bangalore.
4	Structural Masonry- Henry, A.W: Macmillan Education Ltd., 1990.
5	RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
6	LEED India, Green Building Rating System, IGBC pub.
7	IGBC Green Homes Rating System, CII pub.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓					
CO2	✓											
CO3	✓	✓	✓					✓				✓

Course Title	**TRAFFIC ENGINEERING**						
Course Code	**21CVTE6044**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To understand the fundamental knowledge of traffic engineering, scope, basic techniques for collecting and analysing traffic data, diagnosing problems with effective design of facilities and to apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety. Analyse the traffic issues including safety, planning, design, operation and Control by intelligent transport system and its applications in the present traffic scenario.

UNIT – I **8 Hours**

INTRODUCTION:

Definition, objectives of Traffic Engineering and scope of Traffic Engineering. Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures,

TRAFFIC CHARACTERISTICS:

Road user characteristics, vehicular characteristics, static and dynamic characteristics, power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Problems on above.

UNIT – II **8 Hours**

TRAFFIC STUDIES:

Various types of traffic engineering studies, data collection, analysis objectives and method of study,

INTERPRETATION OF TRAFFIC STUDIES:

Classified traffic Volume at mid-block and intersections, PCU, origin and destination, spot speed, speed and delay, parking – on street parking & off street parking, Accident – causes, analysis measures to reduce accidents – problems on above.

UNIT – III **8 Hours**

TRAFFIC FLOW THEORIES:

Traffic flow theory, Green shield theory –correlation and regression analysis (linear only), Queuing theory and relevant problems.

STATISTICAL ANALYSIS:

Poisson's distribution and Normal Distribution, application to traffic engineering Traffic forecast – simulation techniques.

UNIT – IV **8 Hours**

TRAFFIC REGULATION AND CONTROL:

Driver, vehicle and road controls – Traffic regulations, one way, Traffic markings, Traffic signs, Traffic signals – Vehicle actuated and synchronized signals – Signals co-ordination. Webster's method of signal design, IRC method, traffic rotary elements and designs, traffic operation – Street lighting, Road side furniture, Relevant problems on above.

UNIT – V **8 Hours**

TRAFFIC SAFETY AND ENVIRONMENT:

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

INTELLIGENT TRANSPORT SYSTEM:

Definition, Necessities, Application in the present traffic scenario.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Interpret the relation between various types of traffic engineering studies with respect to objectives and scope of traffic characteristics.
CO2	Apply the fundamental principles of statistics for analysing the traffic flow by various mathematical models.
CO3	Explain the relation between traffic flow, its regulation and control by improvising the various road elements with their design for safe traffic operations.
CO4	Analysing the impact of traffic on safety and environment and promoting the utilization of public transport system.

Reference Books	
1	Traffic Engineering and Transport Planning 5th edition, L.R. Kadiyali- Khanna Publishers, New Delhi.
2	Highway Engineering, 10th edition, Nemchand& Bros- Khanna & Justo, Roorkee (UA).
3	Traffic Engineering. - Matson and Smith:-Mc.Graw Hill and Co publisher.
4	Traffic flow theory – Drew- Mc. Graw Hill and Co publisher.
5	Traffic Engineering, all edition, Pignataro- Prentice Hall publisher.
7	An introduction to traffic engineering- JotinKhistey and Kentlal- PHI publisher.
8	Traffic Engineering- Mc Shane &Roess- PHI publisher.
9	https://archive.nptel.ac.in/courses/105/105/105105215/- Traffic Engineering Nptel Video link
10	https://onlinecourses.nptel.ac.in/noc22_ce41/- Traffic Engineering Course material Nptel link

Question paper pattern:
• The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of three sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓				✓						
CO2	✓		✓		✓				✓			✓
CO3	✓		✓			✓			✓	✓		✓
CO4		✓	✓	✓	✓	✓	✓			✓		

Course Title	**STRUCTURAL DYNAMICS**						
Course Code	**21CVTE6045**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To learn the scope of various field of Civil Engineering, the concepts of sustainable infrastructure. Understand the concepts of force systems to analyze the problems involving with their applications. Study the stability of the shapes with understanding the concepts of centroid and moment of inertia.

UNIT – I **8 Hours**

INTRODUCTION:

Introduction to structural dynamics, brief history of vibration, Basic definitions, vibration of SDOF (Single Degree of Freedom) systems, undamped, Damped, Free vibrations, equivalent viscous damping, Logarithmic decrement

UNIT – II **8 Hours**

SINGLE DEGREE FREEDOM SYSTEM - SDOF:

Forced vibrations of SDOF system, Response of undamped and damped system subjected to harmonic loading, response to SDOF subject to harmonic base excitation, Duhamel's integral, response to general system of loading, dynamic load factor, response spectrum.

UNIT – III **8 Hours**

MULTI DEGREE FREEDOM SYSTEM - MDOF:

Free vibration of MDOF (Multi Degree Freedom System), Natural frequencies, Normal modes, Orthogonality of normal modes, Eigen 8, Values Shear buildings modeled as MDOF systems. Free vibrations, Natural frequencies,

UNIT – IV **8 Hours**

FORCED VIBRATIONS:

Forced vibrations, Motion of shear buildings, Model Superposition Method, Response to shear buildings, Base motion, Harmonic fixed excitation. Damped motion of shear buildings, Equations for damped shear buildings, uncoupled damped equations, Conditions for damping uncoupled.

UNIT – V **8 Hours**

DYNAMIC ANALYSIS:

Dynamic analysis of base stuffiness matrices, Lumped mass and consistent mass formulation, Equations of motion.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Understand the basic concept of dynamics and frame the equations of motion for structures.
CO2	Characterize the dynamic properties of a structure, Apply structural dynamics theory to earthquake analysis, response.
CO3	Evaluate the behaviour of structure subjected to dynamic loading.
CO4	Interpret the dynamic analysis results, Analyse vibration control measures for structures.

Text Books:	
1	Anil K Chopra, "Structural Dynamics", PHI Publications
2	Mukobadhyay, "Vibrations, Structural Dynamics", Oxford IBH Publications
3	Vinod Husur, "Earth Quake resistant design of building structures", WILE EASTERN India Publications

4	V K Mac Subramanian, “Elementary structural dynamics”, Danpatra Publications
5	Mario Paz, “Structural Dynamics”, CBS publications.
6	Manik A Selvam, “Structural Dynamics”, Danpatra publications

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓										
CO3	✓	✓		✓								
CO4	✓	✓		✓								

Course Title	**URBAN TRANSPORT PLANNING**						
Course Code	**21CVTE6051**						
Category	**OPEN ELECTIVE COURSE (OEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To understand and apply basic concepts and methods of urban transportation planning, to explain the various methods of designing, conducting and administering surveys to provide the data required for transportation planning, to understand the process of developing an organized mathematical modeling approach to solve select urban transportation planning problem and to illustrate the various types of models used for travel forecasting, prediction of future travel patterns.

UNIT – I **8 Hours**

INTRODUCTION:

Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning.

Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, Para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

UNIT – II **8 Hours**

DATA COLLECTION AND INVENTORIES:

Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT – III **8 Hours**

TRIP GENERATION :

Trip purpose, Factors governing trip generation and attraction, Category analysis, Problems.

TRIP DISTRIBUTION:

Methods, Growth factors methods and problems.

UNIT – IV **8 Hours**

TRIP DISTRIBUTION:

Synthetic methods- Fractor and Furness method and problems.

MODAL SPLIT:

Factors affecting, characteristics of split, Model split in urban transport planning, problems using excel.

UNIT – V **8 Hours**

TRIP ASSIGNMENT: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to	
CO1	Understand the importance of urban transport planning and administer surveys to provide the data required for transportation planning.
CO2	Supervise the process of data collection about travel behaviour and analyse the data for use in transport planning.
CO3	Apply the fundamental principles of mathematical models for the trip generation and its

	assignment techniques for modal split and trip distribution methods

Reference Books	
1	'Traffic Engineering and Transportation Planning' 5th edition, Dr. Kadiyali. L. R., Khanna Publishers, New Delhi.
2	Principles of urban transport systems planning by Hutchinson, B. G. Publication date: 2010 Publisher: Washington, Scripta Book Co.
3	Introduction to transportation engineering- Jotin Kristey and Kentlal - PHI, New Delhi.
4	Urban Transport planning- Black John, Croom Helm limited- 1981, London, England.
5	Urban and Regional models in geography and planning- Wilson, A. G– John Wiley & Sons Inc Publishers
6	Transportation Engineering and Planning- Papacostas, Publisher-Prentice Hall India Learning Private Limited; 3rd edition

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓						
CO2	✓	✓										
CO3	✓	✓										✓

Course Title	AIR POLLUTION AND CONTROL METHODS						
Course Code	21CVTE6052						
Category	OPEN ELECTIVE COURSE (OEC)						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	0	0	0	3	40	03
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 03 hours		

Course Learning Objective:

CLO1: Understand primary pollutants and study the formation of secondary air pollutants in the atmosphere.

CLO2: Study the influential factors (meteorological parameters) of air pollutants transportation in the atmosphere.

CLO3: Study the effects of air pollution on receptor (human, different species, and environment, etc.,

CLO4: Learn the various air pollution control methods and to create awareness through community participation and legislation.

UNIT – I **8 Hours**

INTRODUCTION:

Definition – Classification and Characterization of Air Pollutants, Emission Sources, Behaviour and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo - chemical Smog, Coal-induced smog, Air Pollution Inventories.

EFFECTS OF AIR POLLUTION:

On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

UNIT – II **8 Hours**

METEOROLOGY:

Introduction – Meteorological Variables, Primary and Secondary Meteorological Variables, Stability Conditions, Wind rose, General Characteristics of Stack Plumes and Inversions, Dispersion Models – Gaussian Plume Model.

UNIT – III **8 Hours**

METEOROLOGY: (Contd.)

Factors to be considered in Industrial Plant Location and Planning.

SAMPLING AND ANALYSIS:

Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement.

UNIT – IV **8 Hours**

AIR POLLUTION CONTROL METHODS:

Air Pollution Control Methods – Particulate Emission Control; Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions; Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

UNIT – V **8 Hours**

AIR POLLUTION DUE TO AUTOMOBILES:

Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.

ENVIRONMENTAL ISSUES:

- ✓ Acid Rain
- ✓ Global Warming
- ✓ Ozone Depletion in Stratosphere
- ✓ Indoor Air Pollution

ENVIRONMENTAL LEGISLATION:

Environmental Policy, Environmental Protection Act, Air Pollution Standards.

Course Outcomes: The students will be able to	
1	Identify the various sources and formation of pollutants thoroughly and explain the effect of air pollutants on receptors (human, different species, materials and surrounding environment).
2	Understand the behaviour of pollutants in the atmosphere and the importance of the meteorological parameters and various dispersion Modeling methods.
3	Classify the various air pollutants sampling methods, analysis methods and also the factors to select a suitable industrial plant location to prevent and control the global air pollution.
4	Discus the air pollution episodes, control policies and climate changes like global warming, Ozone depletion, Indoor air pollution, Acid rain and vehicular pollution.

Question paper pattern:
• The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub - questions) from each unit. • Each full question will have sub - question covering all the topics under a unit. • The students will have to answer five full questions, selecting one full question from each unit.

Text Books	
1	Air Pollution by M.N Rao and HVN Rao 2017 edition
2	Air Pollution by Rajni kand and Keshav Kant, Khanna Publishing 2019 edition
3	Air Pollution control by KVSG Murali Krishna USP Publishers 2017
4	Air Pollution and control by Anjaneyalu, 2017 edition

Reference Books:	
1	Boubel, R.W., Donald, L.F., Turner, D.B., and Stern, A.C., (1994), Fundamentals of Air Pollution – Academic Press.
2	Crawford, M., (1980), Air Pollution Control Theory –TMH Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi
3	Henry. C. Perkins, (1980), Air Pollution –McGraw Hill.
4	Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), Environmental Engineering –Mc Graw Hill Book Co
5	Sincero, A.P and Sincero, G.A., (1999), Environmental Engineering – A Design Approach –Prentice Hall of India.
6	Wark, K., Warner, C.F. and Davies, W.T., (1998), Air Pollution- Its Origin and Control –Harper & Row Publishers, New York

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓	✓			✓		
CO2		✓								✓		
CO3			✓			✓	✓		✓	✓		✓
CO4		✓				✓				✓		✓

Course Title	**INTEGRATED SOLID WASTE MANAGEMENT**						
Course Code	**21CVTE6053**						
Category	**OPEN ELECTIVE COURSE (OEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: Understand the key principles and concepts of integrated solid waste management (ISWM), including waste generation, collection, treatment, and disposal. Analyze and evaluate different waste management strategies and technologies, considering their environmental, health impacts. Apply practical knowledge of waste reduction, recycling, composting, and energy recovery techniques to develop sustainable waste management plans. Demonstrate the ability to develop and implement comprehensive ISWM plans that align with regulatory requirements, community needs, and sustainability goals.

UNIT – I **8 Hours**

INTRODUCTION AND WASTE GENERATION ASPECTS:

Sources, types, functional elements of solid waste management, factors affecting solid waste generation and management, waste characteristics, health and environmental effects. Numerical on moisture content, density and energy content.

UNIT – II **8 Hours**

WASTE PROCESSING TECHNIQUES:

Purpose of processing, volume and size reduction, component separation, significance of source reduction, product recovery and recycling, planning of a recycling programme, recycling programme elements, commonly recycled materials and processes.

COLLECTION, STORAGE, TRANSPORT OF WASTES:

Collection components, storage-containers/collection vehicles, collection operation and route optimization, need and types of transfer stations, location of transfer station. Estimation of solid waste quantities.

UNIT – III **8 Hours**

BIOLOGICAL CONVERSION TECHNOLOGIES:

Definition of compost, classification of composting, key process variables of composting, different types of composting- aerobic composting, windrow composting, in-vessel composting, aerated static pile composting, vermicomposting, anaerobic composting. Site selection and design of composting. Specifications for composting as per Solid Waste Management Rules-2016.

THERMAL CONVERSION TECHNOLOGIES:

Definition of thermal process, categories of thermal conversion, Combustion Systems-Mass fired combustion systems, RDF-Fired combustion system, Fluidized bed combustion. Pyrolysis Systems, Gasification Systems. Environmental and air pollution control systems. Air Quality standards as per Solid Waste Management Rules-2016.

UNIT – IV **8 Hours**

DISPOSAL OF SOLID WASTES:

Sanitary landfills- Definition, environmental impact and its minimization, Landfilling methods-trench method, area method and canyon method. Essential components, site selection, landfill planning and design factors. Generation, movement and control of landfill gases. Formation, movement and control of leachate. Different types of Liner systems. Landfill closure and post closure care. Numerical on landfill area estimation. Specifications for Sanitary Landfills as per Solid Waste Management Rules-2016.

UNIT – V **8 Hours**

SPECIAL WASTE MANAGEMENT:

Definition, importance of special waste Management, Automotive Wastes, Construction and Demolition Wastes, Electronic Wastes, Industrial Solid Wastes, Medical Wastes, Plastic Wastes, Lead Battery Wastes

(environmental significance, recovery, recycle and current management systems). Waste Management Laws in India.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos and waste collection and disposal site visit.

Course Outcomes: The students will be able to	
CO1	Narrate the basics of solid waste management towards sustainable development.
CO2	Apply technologies to process waste for product and energy recovery options.
CO3	Comprehend the principles and practices involved in the safe and environmentally sound disposal Technique.
CO4	Analyze the need for special wastes management for safe and sustainable disposal.

Text Books:	
1	Ramesha Chandrappa and Diganta Bhusan Das "Solid Waste Management: Principles and Practice", Springer Berlin Heidelberg, 2012..
2	George Tchobanoglous, Hilary Theisen, Samuel Vigil, "Integrated Solid Waste Management: Engineering Principles and Management Issues", McGraw-Hill Companies, Incorporated, 1993.
3	William A. Worrell and P. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning Inc, 2012.
4	Dr. R.Saravanan, "Municipal Solid Waste Management", Suchitra Publications, 2017.
5	P. White, M. Franke , P. Hindle "Integrated Solid Waste Management: A Lifecycle Inventory", 1995.
6	Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, "Environmental Engineering", McGraw Hill International Editions, 1985.
7	Sunil Kumar, "Municipal Solid Waste Management in Developing Countries", CRC Press, 2016.
8	Sunil Kumar, "Municipal Solid Waste Management in Developing Countries", CRC Press, 2016.
9	George Tchobanoglous and Frank Kreith, "Handbook of Solid Waste Management", 2nd Edition, The McGraw-Hill Companies, Inc., 2002.
10	https://onlinecourses.nptel.ac.in/noc19_ce31/preview
11	https://archive.nptel.ac.in/courses/105/103/105103205/
12	https://www.digimat.in/nptel/courses/video/105102160/L06.html

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓										✓
CO3	✓			✓								✓
CO4	✓						✓					✓

Course Title	**NATURAL DISASTER MITIGATION AND MANAGEMENT**						
Course Code	**21CVTE6054**						
Category	**OPEN ELECTIVE COURSE (OEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To understand fundamental concepts relevant to natural disasters, their significance, and types. To analyze the factors that causes the disaster and disaster management cycle and apply the approaches of Disaster Risk Reduction (DRR) and inter-relation between disaster and development. To understand the regulations, application of science and technology in disaster management and disasters risk management in India.

UNIT – I **8 Hours**

INTRODUCTION TO DISASTERS:

Understanding the concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks, Capacity, Disaster and Development, and Disaster Management. 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 – II **8 Hours**

DIFFERENT DISASTERS:

Causes, Impacts: Geological Disasters (earthquakes, landslides, tsunami), Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder, storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire). Technological Disasters (electrical, chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, mining, road and rail accidents) Global Disaster Trends, Emerging Risks of Disasters, Climate Change and Urban Disasters.

UNIT – III **8 Hours**

RISK REHABILITATION AND RECOVERY:

Disaster Management Cycle, Pre-Disaster, Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Capacity Development, Awareness During Disaster, Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Post-disaster, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment.

UNIT – IV **8 Hours**

INTER-RELATIONSHIP BETWEEN DISASTERS & DEVELOPMENT:

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc., Climate Change Adaptation, IPCC Scenario and Scenarios in the context of specific region, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT – V **8 Hours**

DISASTER RISK MANAGEMENT IN INDIA:

Hazard and Vulnerability profile of India, Mega disasters of India, Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation. Disaster Management Act and Policy, Disaster Safe Designs and Constructions S&T Institutions for Disaster Management in India

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and experimental learning in Laboratory.

Course Outcomes: The students will be able to

CO1	Understand the concepts of disaster, various types of disasters, causes and their impact on environment and society.

CO2	Understand the vulnerability and apply various methods of risk reduction measures, disaster preparedness as well as mitigation.
CO3	Describe the inter-relationship between disasters & development.
CO4	Discuss the hazards and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment, Act and Policies.

Text Books:	
1	Time Saver Standards, Hancock Callender, Building Types.
2	Natural Hazards In The Urban Habitat By Iyengar, C.B.R.I., Tata Mcgraw Hill. Pub
3	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. Isbn-10: 9380386427 Isbn-13: 978-9380386423
4	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge For Disaster Risk Management, NIDM, New Delhi, 2011
5	Disaster Management –Future Challenges & Opportunities By Jagbir Singh, I.K. International Publishing House.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓	✓				✓	✓					
CO3	✓	✓										
CO4	✓					✓						✓

Course Title	**ESTIMATION AND VALUATION**						
Course Code	**21CVT701**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:

To inculcate the knowledge of measuring the quantity and checking the executed quantity in civil Engineering works, to develop the knowledge of calculating the rate of items of work using civil engineering methods, to understand the specification of all the civil engineering works to be executed as per the standards/design and also to gain knowledge of land appreciation and depreciation value.

UNIT – I **8 Hours**

ESTIMATION:

Study of various drawings with estimates, important terms, Units of measurement, Different type of estimates, Approximate methods of estimating buildings, Cost of materials.

Abstract methods of taking out quantities and cost– Long and short wall method, Centre line method.

Preparation of detailed and abstract estimates Buildings, RCC framed structures with all Building components.

UNIT – II **8 Hours**

ESTIMATION (continued):

Preparation of detailed and abstract estimates for the following Civil Engineering works-

Estimation of wooden joineries such as doors, Windows and ventilators;

Estimation of manhole and septic tanks, RCC Culverts; Steel truss (Fink and Howe truss)

UNIT – III **8 Hours**

SPECIFICATIONS:

Definition of specifications, Objective of writing specifications, Essentials in specifications, General and detailed specifications of common item of works in buildings.

RATE ANALYSIS:

Definition and purpose, Working out quantities and rates as per SR for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, Centering and form work for different RCC items, wood and steel works for doors, windows and ventilators.

UNIT – IV **8 Hours**

CONTRACT MANAGEMENT:

Invitation to tender, Prequalification, Pre-tender study, Administrative approval & Technical sanction, Bid submission and Evaluation process. Earnest money deposit, Security deposit,

Types of contract, Essentials of contract agreement- Legal aspects, Penal provisions on breach of contract, Acceptance of contract documents, Termination of contract, Preparation of bills, Indian contract act, Arbitration.

UNIT – V **8 Hours**

VALUATION:

Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value, Freehold, Lease hold and Easement, Sinking fund, Depreciation– methods of estimating depreciation, RBI inflation formula, RERA.

TECHNIQUES:
Market analysis, Legal and political analysis, The role of valuation in real estate investment, Process and methods of valuation: Rent fixation, Valuation for mortgage, Valuation of land.

Course Outcomes: The students will be able to	
CO1	Interpret construction drawings and take out quantities, work out the cost and prepare the abstract for the estimated cost for various civil engineering works.
CO2	Prepare the specifications and analyse the rates for various items of work.
CO3	Understand various aspects of contract management and its implementation.
CO4	Summarize valuation and identify the techniques of valuation process.

Teaching & Learning Process:
Chalk and talk, Power point presentations.

Text Books:	
1	Estimating & Costing, B. N. Dutta, Chand Publisher, 2016
2	Estimating & Specification - Charotar Publishing House Pvt. Ltd.; 17th Edition, 2017.
3	Estimating, costing, specification and Valuation in Civil Engg., Chakraborti; 29th Edition, 2006.
References:	
1	Estimating & Costing- G. S. Birdie, Dhanpath Rai and sons: New Delhi 2014
2	Contracts and Estimates, B. S. Patil, University Press, 2006.
3	Estimating and Costing (Civil), D.D.Kohli and R.C.Kohli, S Chand, 13th Edition
4	Quantity Surveying- P. L. Basin S. Chand: New Delhi
5	Schedule of Rates book, 2024 (KPWD/CPWD)
6	IS 1200:1992 , IS 3861:2002- Method of measurement of building and civil engineering works
7	SP 27:1987- Handbook of method of measurement of buildings

Process of Assessment (both CIE and SEE):
50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

- ✓ Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.
- ✓ First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester.
- ✓ The makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.
- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.
- ✓ Group discussion /Activities / Seminar / Quiz will be planned suitably to attain the Cos and POs and PSo.
- ✓ At the end of the 13th week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the

outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓						✓
CO2	✓					✓						✓
CO3			✓					✓			✓	✓
CO4			✓					✓	✓		✓	✓

COURSE TITLE	**PRE-STRESSED CONCRETE**						
Course Code	**21CVT702**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	2	**0**	**0**	**0**	**2**	**25**	**02**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 02 Hours**		

Course Learning Objectives To provide general principles of PSC members and design using the latest IS: 1343 code. To provide methods of design for bending, shear, and torsion of PSC structural elements.

UNIT – I **5 Hours**

INTRODUCTION:

Historic development- general principles of Prestressing, Types of pre stressing, pre- tensioning and post tensioning, advantages and limitation of prestressed concrete, Materials for pre stressed concrete- high strength steel and concrete, properties, Stress-strain characteristics of high strength steel and concrete.

BASIC PRINCIPLES OF PRESTRESSING:

Fundamentals of prestress, Load balancing concept, Stress concept, center of thrust, Pretensioning and post tensioning methods-Analysis of Pretensioning and post tensioning, Systems of pre stressing, End anchorages.

UNIT – II **5 Hours**

ANALYSIS OF SECTIONS FOR FLEXURE:

Elastic analysis of pre stressed concrete beams with straight, parabolic, triangular, trapezoidal cable profiles, Combination of cable profiles, Eccentric and concentric pre stressing,Numerical problems.

UNIT – III **5 Hours**

LOSSES OF PRE-STRESS:

Loss of prestress in pretensioned and post tensioned members due to elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage and frictional losses, Numerical on Losses during Prestress.

UNIT – IV **5 Hours**

DEFLECTIONS:

Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection. Numerical on Short term and Long term deflections.

UNIT – V **5 Hours**

LIMIT STATE OF COLLAPSE:

Flexure - IS Code recommendations – Ultimate flexural strength of sections. Numerical on Flexure.

Shear - IS Code recommendations, shear resistance of sections, shear reinforcement.

Limit state of serviceability – Control of deflections and cracking, Numerical on Shear.

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

- ✓ Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.
- ✓ First test at the end of 5^{th} week of the semester and Second test at the end of the 10^{th} week of the semester.
- ✓ The makeup test at the end of the 15^{th} week of the semester given for the students for whom are not

attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.

- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.
- ✓ Group discussion /Activities / Seminar / Quiz will be planned suitably to attain the Cos and POs and PSo.
- ✓ At the end of the 13th week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 02 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 10 marks and there will be 2 questions from each unit / module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- Each unit has two full questions with internal choice.
- Each full question will have a maximum of two sub question.
- Each full question will be for 10 Marks.
- Students will have to answer five full questions, selecting one full question from each unit

Course Outcomes: The students will be able to	
CO1	Explain the basic concept of pre-stressing, post-tensioning, behavior of PSC members and use of high tensile strength steel.
CO2	Analyze the pre-stress in pre-Tensioning and Post -Tensioning elements.
CO3	Calculate deflection in PSC members with respect to short and long time application of forces.
CO4	Analyze and design of beams for flexure both serviceability and economic point of view.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations, Videos and experimental learning in Laboratory.

Text Books:	
1	Pre-stressed Concrete- N. Krishna Raju, Tata McGraw Publishers, 6th *Edition* (2022).
2	Pre-stressed Concrete- P Dayaratnam And P Sarah. Medtech Publisher, *7th* Edition *(2017).*
3	Pre-stressed Concrete- N. Rajgopalan, Alpha Sceince Publishers, 2nd *Edition* (2017).

Reference Books:	
1	Code of practice for Prestressed Concrete - IS: 1343: 2012.
2	Design of Pre-Stressed Concrete Structures- T.Y. Lin and Ned H. Burns - John Wiley & Sons, Wiley India Private Limited; 3rd Edition (2010).
3	Design of Pre-Stressed Concrete – Arthus H Nilson. Wiley Publishers, 2nd Edition (1991).
4	Fundamental of Pre-Stressed Concrete- N. C. Sinha & S. K. Roy, S Chand Publishing; 3rd Edition (2011).

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓									✓		
CO2		✓										

CO3	✓	✓					✓					
CO4	✓	✓	✓	✓								✓

Course Title	**FOUNDATION ENGINEERING**						
Course Code	**21CVT7031**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objectives: The students will be learn to understand the stress distributions and compressibility characteristics of soil, know the earth pressure against retaining walls and stability of slopes against shear failure and interpret the soil condition at a given location and suggest the suitable type of foundation.

UNIT – I **08 Hours**

STRESS DISTRIBUTION IN SOILS:

Boussinesq's and Westergaard's theories for different types of loads, Pressure distribution diagrams, Approximate and exact methods, Newmark's influence chart, Contact Pressure.

FOUNDATION SETTLEMENTS:

Immediate, Primary consolidation and Secondary settlement.

UNIT – II **08 Hours**

LATERAL EARTH PRESSURE:

Types of earth pressure, Rankine's theory of applications (Dry, moist, submerged, partially submerged, uniform surcharge, layered cohesionless, cohesive and cohesive – friction backfill). Graphical methods to compute active earth pressures for cohesionless backfill by Rebhaunn's and Culmann's method.

UNIT – III **08 Hours**

STABILITY OF EARTH SLOPES:

Factor of safety, Stability analysis of Infinite slopes by limiting equillbrium condition, Stability analysis of finite slopes by Swedish slip circle methods, Friction circle method, Fellineous method, Taylor's stability number.

UNIT – IV **08 Hours**

BEARING CAPACITY OF SHALLOW FOUNDATION:

Definitions of bearing capacity terms, Modes of shear failure, Terzaghi's and IS: 6403 method bearing capacity equations, Effect of ground water table and loading eccentricity on footing. Field methods to evaluation of allowable bearing capacity - Plate load test and Standard penetration test.

UNIT – V **08 Hours**

BEARING CAPACITY OF PILE FOUNDATION:

Classification of piles, Load transfer mechanism, Pile capacity by Static formulae, Dynamic formulae and Pile load test, Pile group, Efficiency, Bearing capacity and settlement of piles on clayey soils, Negative skin friction, Underreamer piles.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos.

Course Outcomes: The students will be able to	
CO1	Estimate the state of stress below any type of loaded area and compute settlement.
CO2	Estimate lateral earth pressures exerted on retaining walls and factor of safety against shear for slopes.
CO3	Evaluate bearing capacity of soil to design a shallow and deep foundations.

Text Books:	
1	Soil Mechanics and Foundation Engineering, Punmia B C, 17th Edition (2021), Laxmi Publications Co., New Delhi.
2	Basic and Applied Soil Mechanics - Gopal Ranjan and Rao A.S.R., 4th Edition (2022), New Age International (P) Ltd., New Delhi.
3	Geotechnical Engineering- Braja, M. Das, 8th Edition (2012), Thomson Business Information India (P) Ltd., India.
4	Principles of Soil Mechanics and Foundation Engineering- Murthy V. N. S., 12th Edition (2018), UBS Publishers and Distributors, New Delhi.

Reference Books:	
1	"Foundation analysis and design", Bowles J. E. (2001), 5th Edition, McGraw- Hill Publications. New Delhi.
2	"Soil Mechanics in Engineering Practice", Karl Terzaghi, Ralph B. Peck, Gholamreza Mesri (1996), 5th Edition, John Wiley & Sons Publishers.
3	"A Hand Book of Stress Distribution and Deformation in Soils", B.K. Ramaiah, Purushotham Raj, Krishnamurthy, Bangalore University (1970).
4	"Code of Practice for Determination of Bearing Capacity of Shallow Foundations", IS: 6403 – 2004, 7th Revision, Bureau of Indian Standards, New Delhi.
5	"Code of Practice for Design and Construction of Pile Foundations", IS: 2911(Part 1/Sec 1) – 2010, 2nd Revision, Bureau of Indian Standards, New Delhi.

Process of Assessment (both CIE and SEE):

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- ✓ At the end of the 13th week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							
CO2	✓	✓			✓							
CO3	✓		✓				✓			✓		

Course Title	**EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**						
Course Code	**21CVT7032**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	0	0	0	3	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To understand the fundamental concepts of earthquake engineering, terminologies, and dynamics. To analyse the earthquake response of a single, multi-story building and shear wall and to review the latest Indian seismic codes to apply in the planning, design, and detailing of earthquake-resistant buildings.

UNIT – I **8 Hours**

EARTHQUAKE ENGINEERING:

Engineering Seismology, Earthquake Phenomenon, Causes and effects of earthquakes, Faults, Structure of earth, Plate Tectonics, Elastic Rebound Theory.

Earthquake Terminology: Source, Focus, Epicenter, Earthquake Size, Magnitude and intensity of earthquakes, Classification of earthquakes, Seismic Waves, Seismic Zoning Map of India, Micro zonation Seismograms and Accelerograms.

UNIT – II **8 Hours**

INTRODUCTION TO STRUCTURAL DYNAMICS:

Theory of vibrations, Lumped mass, Single Degree of Freedom (SDOF) Systems, Multi degree of freedom, Formulation of equation of motion- Undamped and damped free vibration, Damping, Concept of response spectrum.

UNIT – III **8 Hours**

EARTHQUAKE ANALYSIS:

Introduction, Rigid base excitation, Earthquake design philosophy, Assumptions, Analysis by seismic coefficient and response spectrum methods, Analysis of Single and multistoried building using Seismic Coefficient method.

CODAL DESIGN PROVISIONS:

Review of the latest Indian seismic code IS: 1893–2016 (Part-I) provisions for buildings, Displacements and drift requirements and Provisions for torsion.

UNIT – IV **8 Hours**

A SEISMIC PLANNING:

Plan Configuration, Torsion irregularities, Re-entrant corners, Non-parallel systems, Diaphragm Discontinuity, Vertical Discontinuities in load path, Irregularity in strength and stiffness, Mass Irregularities, Vertical Geometric Irregularity-Proximity of Adjacent Buildings.

UNIT – V **8 Hours**

CODAL DETAILING PROVISIONS:

Review of the latest Indian code IS: 13920-2016, Provisions for ductile detailing of R.C buildings, Beam, column, and joints.

SHEAR WALL:

Types, Design of shear wall, detailing of shear wall as per IS 13920: 2016.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos.

Course Outcomes: The students will be able to	
CO1	Understand the concepts of earthquake engineering and terminologies.
CO2	Discuss fundamental concepts of structural dynamics.
CO3	Analyse the earthquake response of a single, multi-storeyed buildings and shear wall.

CO4	Discuss latest Indian seismic codes in planning, Design and detailing of earthquake resistant buildings.

Text Books:	
1	Pankaj Agarwal &Manish Shrikhande, "Earthquake Resistant Design of Structures" Printice Hall of india, New Delhi.
2	S.K. Duggal," Earthquake Resistant Design of Structures", Oxford University press, New Delhi.
3	A K Chopra," Dynamics of structures" Pearson education, Indian branch, New Delhi.
4	Mario Paz, "Structural Dynamics - Theory and Computations", 6th Edition, Pearson Education, 2005.

Reference Codes:	
1	IS 1893: Part 1: 2016: Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings.
2	IS 13920: 2016: Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice, Bureau of Indian Standards, New Delhi.
3	Earthquake Tips by IIT Kanpur 2024.

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CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓											✓
CO3	✓	✓	✓									✓
CO4	✓											✓

Course Title	**ENVIRONMENTAL IMPACT ASSESSMENT**						
Course Code	**21CVT7033**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:

To foresee the potential environmental problems that would arise out of a proposed development, examine and select the suitable methodology for the various project options and predict significant environmental impact, identify the appropriate abatement and mitigating measures for the implementation of projects.

UNIT – I **8 Hours**

INTRODUCTION TO EIA:

Ecological Factors and Development Activity and, EIA, Rapid and Comprehensive EIA, EIS, FONSI. Need for EIA Studies, Baseline Information, Step-by-step procedures for conducting EIA, Limitations of EIA.

UNIT – II **8 Hours**

METHODOLOGIES OF EIA:

Frame work of Impact Assessment. Developmental Projects- Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies, Techniques of EIA.

UNIT – III **8 Hours**

ENVIRONMENTAL ATTRIBUTES:

Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

UNIT – IV **8 Hours**

PUBLIC PARTICIPATION PROGRAM :

Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements.

Salient Features of the Project Activity-Environmental Parameter Activity Relationships - Matrices.

UNIT – V **8 Hours**

EIA FOR PROJECTS:

EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

Course Outcomes: The students will be able to	
CO1	Explain systematic identification and evaluation of the potential impacts of proposed projects on components of the total environment.
CO2	Apply and identify the measures to be adopted to avoid environmental impact and reinforce a commitment in an organized and systematic approach by involving agencies and public participation.
CO3	Develop environmental protection mechanism for the proposed projects to protect and restore good environment with sustainable development.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	Methodologies for Environment Impact Assessment - Anjaneyalu. Y, B S publications.

2	Environment Impact Assessment – N.S. Raman, A.R Gajbhiye and S.R. Khandeshwar, dreamtech press.
3	Environment Impact Assessment – R.R. Barthwal, New Age International Publishers.

Reference Books:	
1	Environmental Impact Analysis-Jain R.K.-Van Nostrand Reinhold Co.
2	Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
3	Environment Impact Assessment - Larry W. Canter - McGraw Hill

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CO-PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	✓					✓	✓					

2		✓				✓				✓		
3	✓						✓		✓		✓	

Course Title	**RAILWAYS, AIRPORT, TUNNEL AND HARBOUR ENGINEERING**						
Course Code	**21CVT7034**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: To summarize the various aspects of tracks like, geometrical elements, points and crossings, and significance of maintenance, to plan and design of airport layout, facilities required for runway, taxiway and impart the knowledge about visual aids, to apply the design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

UNIT – I **8 Hours**

INTRODUCTION TO RAILWAYS:

Role of railways in transportation, Indian Railways, Selection of Routes, Permanent way and its requirements, Gauges and types, Typical cross sections-single and double line broad gauge (BG) track in cutting, embankment and electrified tracks, Coning of wheels and tilting of rails.

RAILS:

Functions-requirements - types and sections, length-defects-wear-creep-welding-joints, creep of rails.

SLEEPERS AND BALLAST:

Functions, requirements, Types, Track fitting and fasteners-Dog spike, screw spike and Pandrol clip, Fish plates, bearing plates, Calculation of quantity of materials required for laying a track-Examples, Tractive resistances and hauling capacity with examples.

UNIT – II **8 Hours**

GEOMETRIC DESIGN AND POINTS AND CROSSING:

Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right and Left hand turnouts only), Numericals.

RAILWAY CONSTRUCTION AND MAINTENANCE:

Stations and Types, Types of yards, Signalling-Objects and types of signals, station and yard Equipment-Turn table, Fouling mark, buffer stop, level crossing, track defects, and maintenance.

Earthwork – Stabilization of track on poor soil, Construction and maintenance of tracks, Modern methods of construct ion & maintenance – Urban rail – Infrastructure for Metro, Mono and underground railways.

UNIT – III **8 Hours**

AIRPORT PLANNING:

Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

UNIT – IV **8 Hours**

AIRPORT DESIGN:

Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting, Numericals.

UNIT – V **8 Hours**

HARBOUR ENGINEERING:

Harbour classifications, Layout with components, Natural phenomenon affecting the design of harbours - wind, wave and tide, currents, Breakwater-Types Wharf and Quays, Jetties and Piers, Dry dock and wet docks.

TUNNEL ENGINEERING:

Advantages and disadvantages, Size and shape of tunnels, Surveying-Transferring center line, and gradient

from surface to inside the tunnel, Examples, Tunneling in rocks-methods, Tunneling methods in soils-Needle beam, Liner plate, Tunnel lining, Tunnel ventilation, vertical shafts, Pilot tunneling, mucking and methods, drilling and drilling pattern.

Course Outcomes: The students will be able to	
CO1	Understand the knowledge of geometric design of railways and its considerations with different materials used for the construction of railway track.
CO2	Study the basic components of air craft and airport facilities with the design of run way length and geometrics of various landing aids in an airport.
CO3	Understand the fundamental principles related to methods of tunneling and harbours with their layout and components.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	Railway Engineering - Saxena and Arora, Dhanpat Rai & Sons, 7th edition (2015), New Delhi.
2	Airport Planning and Design – Khanna Arora and Jain, Nem Chand Bros, 6th edition (2015), Roorkee.
3	Docks and Tunnel Engineering – R Srinivasan, Charaotar Publishing House, 28th edition (2019), New Delhi.

Reference Books:	
1	Docks and Harbor Engineering –H P Oza and G H Oza Charaotar Publishing House, 7th edition (2015), New Delhi.
2	Railway Engineering – J S Mundrey, McGraw Hill Publications, 4th edition (2017), New Delhi.

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CO1	✓	✓	✓		✓	✓						✓
CO2	✓	✓	✓			✓						✓
CO3	✓	✓				✓						✓

Course Title	**DESIGN OF IRRIGATION & HYDRAULIC STRUCTURES**						
Course Code	**21CVT7035**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objectives: The students will be learn to analyze and design of gravity and earth dams, Design spillways and aprons for diversion head works and design cross drainage works and chose appropriate canal works.

UNIT – I **08 Hours**

RESERVOIR PLANNING:

Introduction, classification of Reservoirs, Storage zones of a reservoir, Mass curve, fixing capacity of a reservoir, safe yield, problems, Reservoir sedimentation, life of a reservoir, economic height of a dam, Environmental effects of reservoirs.

UNIT – II **08 Hours**

GRAVITY DAMS:

Forces acting on a gravity dam, load combination for design, reaction of foundation and distribution of vertical stress at the base of dam - middle third rule, principal and shear stresses, modes of failure of dam – stability requirements.

UNIT – III **08 Hours**

EARTH DAMS:

Types of earth dams, causes of failure earth dams, safety against overtopping, standard slice method, stability of earth dam against horizontal shear developed at the base of the dam, check for free passage of water through earth dams, safety against piping, protection of upstream slope of an earth dam, protection of downstream slope of an earth dam.

UNIT – IV **08 Hours**

SPILLWAYS :

Introduction, essentials of a spillway, spillway components, factors affecting type & design of spillways. Ogee spillway. Energy dissipation below spillways.

UNIT – V **08 Hours**

DRAWING NOT TO SCALE (To draw only sketch for the given design details without projected views on the working sheet)

- ✓ Surplus weir with stepped apron.
- ✓ Tank Plug sluice without tower head.
- ✓ Tank Plug sluice with tower head.
- ✓ Canal regulator.
- ✓ Earthen Bunds.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos.

Course Outcomes: The students will be able to	
CO1	Understand various aspects of Reservoir planning.
CO2	Analyse the design and construction of gravity and earthen dams.
CO3	Design spillways and aprons for various diversion head works and select particular type of cross drainage work for canal network.

Text Books:	
1	Irrigation Engineering and Hydraulic Structures, S. K. Garg, 12th edition, Khanna Publishers, 2006.
2	Irrigation and Water Resources Engineering, Ashwa G. L., 6th edition, New age Publishers, 2005

3	Irrigation and Water Power Engineering, B. C. Punmia, 16th edition, Laxmi Publishers, 2019.
4	Irrigation, Water Power and Water Resources Engineering, K. R. Arora, 4th edition, Standard book house Publishers, 2014.

Reference Books:	
1	Dam hydraulics, D. L. Visher, W. H. Hager, 8th edition, Wiley Publishers, 2012.
2	Irrigation Water Resources and Water Power Engineering, P. N. Modi, 9th edition, Standard book house Publishers, 2008.
3	Irrigation Engineering, R. K. Sharma, 1st edition, S. Chand Publishers, 2017.

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- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- ✓ **Four** questions are to be set from Units 1, 2, 3 & 4 of which **Two** full questions are to be answered for 40 marks.
- ✓ **Two** questions are to be set from Unit 5 (excluding Earthen Bunds) of which **One** full question is to be answered for 45 marks (drawings to be drawn for the given Data on the Drawing sheet).
- ✓ **One** Question is to be set from Earthen Bunds which is compulsory for 15 marks (To draw sketches for the given details on the drawing sheet).

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							
CO2	✓	✓			✓							
CO3	✓		✓				✓			✓		

Course Title	**PAVEMENT DESIGN**						
Course Code	**21CVT7041**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: Gain knowledge about collecting data required for design, factors affecting pavement design, and pavement maintenance. Excel in the path of stress, strain, and deflection analysis in pavement. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2018, Mcleods, Kansas) and rigid pavement by IRC 58-2015. Understand the multiple causes leading to pavement failure and remedies for the same. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

UNIT – I **8 Hours**

INTRODUCTION:

Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Airfield pavement, Design strategies of variables, Functions of subgrade, sub-base, Base course, surface course, comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions, and Limitations of Boussinesq's theory, Burmister theory and Numericals.

UNIT – II **8 Hours**

DESIGN FACTORS:

Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength, and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above. Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, AASHTO, CBR method, IRC Method (old), CSA method using IRC-37-2018, Numericals.

UNIT – III **8 Hours**

FLEXIBLE PAVEMENT FAILURES, MAINTENANCE AND EVALUATION:

Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkelman beam deflection method, Falling weight deflectometer, GPR method.

UNIT – IV **8 Hours**

STRESSES IN RIGID PAVEMENT:

Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart/equations), problems on above. Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Numericals.

AIRFIELD PAVEMENT:

Design factors for runway pavements, methods for airfield pavement, and Numericals.

UNIT – V **8 Hours**

RIGID PAVEMENT FAILURES, MAINTENANCE AND EVALUATION:

Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints, Numericals.

Course Outcomes: The students will be able to	
CO1	Understand and generate the required data for design of pavement (Highway & Airfield).

CO2	Analyze stress, strain, and deflection by Boussinesq's, Burmister's and Westergaard's theory.
CO3	Design of rigid pavement and flexible pavement conforming to code of practice.
CO4	Evaluate the performance of the pavement and also develop maintenance statement based on site-specific requirements.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	SK Khanna, CEG Justo, and A Veeraragavan, "Highway Engineering," Nem Chand & Brothers (2019).
2	L.R.Kadiyali and Dr.N.B.Lal, "Principles and Practices of Highway Engineering," Khanna publishers (2013).
Reference Books:	
1	Yang H. Huang, "Pavement Analysis and Design", University of Kentucky, (2009).
2	Yoder & Wit Zorac, "Principles of pavement design," John Wiley & Sons (2010).
IRC Codes	
1	Guidelines For The Design Of Flexible Pavements, IRC: 37 - 2018
2	Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, IRC: 58 – 2015.
3	Tentative guidelines for structural strength evaluation of rigid airfield pavements, IRC: 76 – 1979.

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

- ✓ Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.
- ✓ First test at the end of 5^{th} week of the semester and Second test at the end of the 10^{th} week of the semester.
- ✓ The makeup test at the end of the 15^{th} week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.
- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4^{th} week and Second assignment at the end of 9^{th} week of the semester.
- ✓ Group discussion /Activities / Seminar / Quiz will be planned suitably to attain the Cos and POs and PSo.
- ✓ At the end of the 13^{th} week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			✓			✓	✓					✓
CO2	✓	✓	✓									✓
CO3	✓	✓	✓			✓						✓
CO4	✓	✓	✓			✓						✓

Course Title	**DESIGN OF CONCRETE BRIDGE STRUCTURES**						
Course Code	**21CVT7042**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: This course will enable students to understand the fundamentals of bridge engineering, analysis and design of various components and structure of concrete Bridges.

UNIT – I **8 Hours**

INTRODUCTION TO BRIDGES:

Definition of bridge and basic forms, components of a bridge, classification, selection of bridge site and preliminary data and drawings, computation of discharge, linear waterway, economic span, afflux, scour depth. Design loads for bridges, Introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per IRC 6 and IRC 21. Fundamentals of Precast Bridge components.

UNIT – II **8 Hours**

PIERS, ABUTMENT & BEARINGS:

Materials, forces acting on piers and abutments, types of pier and abutment, design considerations, stability analysis of pier and abutments.

Bearings- Introduction to Bridge bearings, Hinges and Expansion joints. Design of Elastomeric Pad Bearings

UNIT – III **8 Hours**

SLAB CULVERT:

Design of Slab Culvert with reinforcement for IRC Class AA Tracked Vehicle loading, Wheeled Vehicle loading and IRC 70R loading. Concepts and Design Principles of Skew Bridges.

UNIT – IV **8 Hours**

BOX CULVERT AND PIPE CULVERT:

Design of Box culvert: General features, design loads, critical sections.

Design of Pipe culverts: General features, classification of pipes, reinforcement in pipes, design principles, design as per IS 458.

UNIT – V **8 Hours**

T BEAM BRIDGES:

Design of T beam bridges (up to three girder only) Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

Course Outcomes: The students will be able to	
CO 1	Understand the fundamentals of bridge engineering.
CO 2	Comprehend bearings & stability analysis of piers and abutments.
CO 3	Design the Slab, Box culvert & Pipe culvert.
CO 4	Design of Interior slab, main girder & cross girder.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos.

Text Books:

1	Design of Bridges, N Krishnaraju, 5th Edition (2019), Oxford & IBH Publishing Co. PVT. LTD.
2	Raina V K Concrete Bridge Practice, 4th Edition (2018), Construction, Maintenance & Rehabilitation Tata McGraw Hill.
3	Johnson Victor. D, "Essentials of Bridge Engineering", 6th Edition (2021), Oxford Publishing Comp.
4	T R Jagadeesh and M A Jayaram, "Design of bridge structures", 3rd Edition (2020), Prentice Hall of India.

Reference Books:	
1	Jain and Jaikrishna, "Plain and Reinforced Concrete", 8th Edition (2020), Vol. (II), Nem Chand Brothers.
2	Vazirani,Ratvani & Aswani, "Design of Concrete Bridges", 5th edition Khanna Publiashers,2006
3	IRC 6 Standard Specifications and code of practice for road bridges
4	IRC 21 Standard Specifications and code of practice for road bridges
5	IS 458 Precast concrete pipes with and without reinforcement

Process of Assessment (both CIE and SEE):

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- ✓ The makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.
- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.
- ✓ Group discussion /Activities / Seminar / Quiz will be planned suitably to attain the Cos and POs and PSo.
- ✓ At the end of the 13th week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓										✓
CO3	✓	✓	✓	✓								✓
CO4	✓	✓	✓	✓								✓

Course Title	**AIR POLLUTION AND CONTROL**						
Course Code	**21CVT7043**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective:

Understand primary pollutants and study the formation of secondary air pollutants in the atmosphere. Study the influential factors (meteorological parameters) of air pollutants transportation in the atmosphere. Study the effects of air pollution on receptor (human, different species, and environment, etc., Learn the various air pollution control methods and to create awareness through community participation and legislation.

UNIT – I **8 Hours**

INTRODUCTION:

Definition – Classification and Characterization of Air Pollutants, Emission Sources, Behaviour and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo - chemical Smog, Coal-induced smog, Air Pollution Inventories.

EFFECTS OF AIR POLLUTION:

On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

UNIT – II **8 Hours**

METEOROLOGY:

Introduction – Meteorological Variables, Primary and Secondary Meteorological Variables, Stability Conditions, Wind rose, General Characteristics of Stack Plumes and Inversions, Dispersion Models – Gaussian Plume Model.

UNIT – III **8 Hours**

METEOROLOGY: (Contd.)

Factors to be considered in Industrial Plant Location and Planning.

SAMPLING AND ANALYSIS:

Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement.

UNIT – IV **8 Hours**

AIR POLLUTION CONTROL METHODS:

Air Pollution Control Methods – Particulate Emission Control; Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions; Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

UNIT – V **8 Hours**

AIR POLLUTION DUE TO AUTOMOBILES:

Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.

ENVIRONMENTAL ISSUES:

- ✓ Acid Rain
- ✓ Global Warming
- ✓ Ozone Depletion in Stratosphere
- ✓ Indoor Air Pollution

ENVIRONMENTAL LEGISLATION:

Environmental Policy, Environmental Protection Act, Air Pollution Standards.

Course Outcomes: The students will be able to	
CO1	Identify the various sources and formation of pollutants thoroughly and explain the effect of air pollutants on receptors (human, different species, materials and surrounding environment).
CO 2	Understand the behaviour of pollutants in the atmosphere and the importance of the meteorological parameters and various dispersion Modeling methods.
CO 3	Classify the various air pollutants sampling methods, analysis methods and also the factors to select a suitable industrial plant location to prevent and control the global air pollution.
CO 4	Discus the air pollution episodes, control policies and climate changes like global warming, Ozone depletion, Indoor air pollution, Acid rain and vehicular pollution.

Text Books	
1	Air Pollution by M.N Rao and HVN Rao 2017 edition
2	Air Pollution by Rajni kand and Keshav Kant, Khanna Publishing 2019 edition
3	Air Pollution control by KVSG Murali Krishna USP Publishers 2017
4	Air Pollution and control by Anjaneyalu, 2017 edition

Reference Books:	
1	Boubel, R.W., Donald, L.F., Turner, D.B., and Stern, A.C., (1994), Fundamentals of Air Pollution – Academic Press.
2	Crawford, M., (1980), Air Pollution Control Theory –TMH Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi
3	Henry. C. Perkins, (1980), Air Pollution –McGraw Hill.
4	Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), Environmental Engineering –Mc Graw Hill Book Co
5	Sincero, A.P and Sincero, G.A., (1999), Environmental Engineering – A Design Approach –Prentice Hall of India.
6	Wark, K., Warner, C.F. and Davies, W.T., (1998), Air Pollution- Its Origin and Control –Harper & Row Publishers, New York

Process of Assessment (both CIE and SEE):

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- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4^{th} week and Second assignment at the end of 9^{th} week of the semester.
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- ✓ At the end of the 13^{th} week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

• The question paper will have ten full questions carrying equal marks.
• Each full question will be for 20 marks.
• There will be two full questions (with a maximum of three sub - questions) from each unit.
• Each full question will have sub - question covering all the topics under a unit.
• The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓	✓			✓		
CO2		✓								✓		
CO3			✓			✓	✓		✓	✓		✓
CO4		✓				✓				✓		✓

Course Title	**REINFORCED EARTH STRUCTURES AND GEOSYNTHETICS**						
Course Code	**21CVT7044**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: This course will enable students to: Create an understanding of the latest technique such as reinforcing the soil, Analyze the concept of RE so as to ascertain stability of RE structures, Understand the different reinforcing materials that can be used efficiently in soils, understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

UNIT – I **8 Hours**

BASICS OF REINFORCED EARTH CONSTRUCTION:

Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

GEOSYNTHETICS AND THEIR FUNCTIONS:

Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics.

PROPERTIES AND TESTS ON MATERIALS PROPERTIES:

Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.

UNIT – II **8 Hours**

DESIGN OF REINFORCED EARTH RETAINING WALLS:

Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

SOIL NAILING TECHNIQUES:

Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing.

UNIT – III **8 Hours**

DESIGN OF REINFORCED EARTH FOUNDATIONS:

Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull-out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

UNIT – IV **8 Hours**

GEOSYNTHETICS FOR ROADS AND SLOPES:

Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes

UNIT – V **8 Hours**

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS:

Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti-clogging, survivability and durability (No Numerical Problems) Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems).

Course Outcomes: The students will be able to

CO1	Identify, formulate reinforced earth techniques that are suitable for different soils and in different structures.
CO2	Understand the concepts of Geo synthetics.
CO3	Design RE retaining structures and Soil Nailing concepts.
CO4	Determine the load carrying capacity of Foundations resting on RE soil bed and asses the use of Geo synthetics in drainage requirements and landfill designs.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	Koerner, R.M. Designing with Geosynthetics. Vols. 1&2, 6th Edition, Xlibris Corporation (2012), USA.
2	Koerner. R.M. & Wesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science (1980), New York.
3	Sivakumar Babu G. L., "An introduction to Soil Reinforcement and Geo synthetics", Universities Press, (2005), Hyderabad
4	Swami Saran, "Reinforced Soil and its Engineering Applications", Tech sar Pvt. Ltd, 3rd Edition, (2017).
5	Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, "Engineering with Geo synthetics", Tata McGraw Hill publishing Company Limited (2018), New Delhi.

Reference Books:	
1	Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
2	Ingold, T.S. & Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
3	Hidetoshi Octial, Shigenori Hayshi& Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
4	Bell F.G, "Ground Engineer's reference Book", Butter worths, London
5	Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.

Process of Assessment (both CIE and SEE):

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outcome defined for the course.

Semester End Examination (SEE):

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- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

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• Each full question will be for 20 marks.
• There will be two full questions (with a maximum of three sub - questions) from each unit.
• Each full question will have sub - question covering all the topics under a unit.
• The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓					✓
CO2	✓	✓					✓					✓
CO3	✓	✓					✓					✓
CO4	✓						✓					✓

Course Title	**GREEN BUILDING SYSTEMS**						
Course Code	**21CVT7045**						
Category	**Professional Elective Course (PEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	0	0	0	3	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: This course will enable students to understand the Definition, Concept & Objectives of the terms cost effective construction and green building, Apply cost effective techniques in construction, Apply cost effective Technologies and Methods in Construction and Understand the Problems due to Global Warming and effectively utilize Renewable Energy in Construction.

UNIT – I
8 Hours
INTRODUCTION:
Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime Pozzolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cementious Components.

UNIT – II
8 Hours
ENVIRONMENTAL FRIENDLY BUILDING TECHNOLOGIES:
Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames.

UNIT – III
8 Hours
GREEN BUILDINGS AND ENVIRONMENT:
Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings.

UNIT – IV
8 Hours
APPLICATION OF RENEWABLE ENERGY IN GREEN BUILDING:
Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Water utilization in Buildings. Management of Solid Wastes, Sullage water and Sewage.

UNIT – V
8 Hours
GREEN BUILDING & RATING SYSTEMS:
BREEAM – LEED - GREEN STAR - GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos.

Course Outcomes: The students will be able to	
CO1	Identify different building materials for construction and Apply effective environmental friendly building technology
CO2	Explain the utility of the Renewable Energy of Green Buildings and Global Warming
CO3	Assess the Green Building on its predicted performance.

Text Books:	
1	HarharaIyer G, Green Building Fundamentals, Second Edition Notion Press, 2022
2	Dr. Adv. Harshul Savla, Green Building: Principles & Practices, Notion Press, 2021
3	Hand Book of Green Building Design and Construction, 2017, Second Edition, Sam Kubba.

Reference Books:	
1	Zero Energy Buildings, 2018, Shady Attia.Hibbler R. C.,
2	Sustainable Construction, 2016, Charles J.Kibert.

Process of Assessment (both CIE and SEE):

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Semester End Examination (SEE):

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- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub - questions) from each unit.
- Each full question will have sub - question covering all the topics under a unit.
- The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							

CO2	✓		✓		✓		✓					
CO3	✓		✓		✓		✓	✓				✓

Course Title	**INTELLIGENT TRANSPORTATION SYSTEMS**						
Course Code	**21CVT7051**						
Category	**Open Elective Course (OEC)**						
Scheme & Credits	No. of Hours per week					Total Teaching hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 hours**		

Course Learning Objective: To have an awareness and scope of transport issues, such as, traffic safety, public transport, advanced vehicle management and control. Learn how Intelligent transport systems (ITS) involve the application of information technology and telecommunications to control traffic, inform travellers and drivers, operate public transport, automating payments, handle emergencies and incidents, operate commercial fleets and freight exchange, and automate driving and safety.

UNIT-1 **8 Hours**

INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS (ITS):

Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

UNIT-2 **8 Hours**

ITS OPERATIONS AND EVALUATION METHODS:

Advanced traveller information systems; transportation network operations; commercial vehicle operations and intermodal freight. Evaluation Methods; Planning and human factor issues for ITS, Case studies on
deployment planning and system design and operation

UNIT-3 **8 Hours**

ITS PLANNING:

Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.

UNIT-4 **8 Hours**

ITS FUNCTIONAL AREAS:

ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility.

UNIT-5 **8 Hours**

ITS APPLICATIONS:

Travel demand management, electronic toll collection, and ITS and road-pricing. Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS Implementations in developed countries, ITS in developing countries.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos.

Course Outcomes: The students will be able to	
CO1	Understand the basic elements, benefits, data collection techniques and various functional areas involved in ITS.
CO2	Explain the planning and operation which helps in sustainable mobility of technology for better transportation system.
CO3	Apply the technology of ITS in various fields of transportation system for the development of the country.

Text Books	
1	Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House Publieshers (2019).
2	Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Publishers (2017).
3	Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS Hand Book (2000).

Reference Books	
1	Sussman, J. M., "Perspective on ITS", Artech House Publishers, (2005).
2	US Department of Transportation, "National ITS Architecture Documentation", (2007).
3	Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", Prentice Hall (2011).

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CO-PO Mapping												
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CO1	✓	✓		✓							✓	
CO2	✓	✓	✓								✓	
CO3	✓	✓	✓								✓	
CO4	✓	✓			✓		✓				✓	

Course Title	**OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION**						
Course Code	**21CVT7052**						
Category	**Open Elective Course (OEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: To gain an historical, economic, and organizational perspective of occupational safety and health, to investigate current occupational safety and health problems and solutions, to identify the causes that influence occupational safety and health and to demonstrate the knowledge and skills needed to identify work place problems and safe work practice.

UNIT – I **8 Hours**

OCCUPATIONAL HAZARD AND CONTROL PRINCIPLES:

Safety, History and development, National Safety Policy. Occupational Safety and Health Act (OSHA), Occupational Health and Safety Administration - Laws governing OSHA and right to know. Accident – causation, Investigation, Investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.

UNIT – II **8 Hours**

ERGONOMICS AT WORK PLACE:

Ergonomics task analysis, Preventing ergonomic hazards, Work space envelops, Visual ergonomics, Ergonomic standards and Ergonomic programs. Emergency response - Decision for action – purpose and considerations.

UNIT – III **8 Hours**

FIRE PREVENTION AND PROTECTION:

Fire Triangle, Fire development and its severity, Effect of enclosures, Early detection of fire, Classification of fire, Fire extinguishers and Fire suppression system, Fire hydrant, Yard hydrant, Sprinkler system, Fire drill, Fire Fighting NOC, Introduction to provisions of fire and life safety as per National Building Code of India, Electrical safety.

UNIT – IV **8 Hours**

HEALTH CONSIDERATIONS AT WORK PLACE:

Types of diseases and their spread, Health emergency. Personal Protective Equipment (PPE) – Types and advantages, Effects of exposure and Treatment for engineering industries, Municipal solid waste. Environment Management Plans (EMP) for safety and sustainability.

UNIT – V **8 Hours**

OCCUPATIONAL HEALTH AND SAFETY CONSIDERATIONS:

Handling of chemicals and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, supervisors and managers.

Course Outcomes: The students will be able to	
CO 1	Acquire knowledge on history of OSHA policies, laws and regulations.
CO 2	Identify hazards in the workplace that pose a danger or threat to the safety or health of people.
CO 3	Control unsafe or unhealthy hazards and propose methods to eliminate the fire hazards.
CO 4	Discuss the role of health and safety in the workplace and effects of industries on environment and to identify workplace hazards, safety considerations and roles and responsibilities of workers, supervisors and managers.

Text Books:	
1	S Sharma, Vineet Kumar, "Safety, Occupational Health and Environmental Management in Construction". Khanna Publisher, 2013.
2	R K Jain, Sunil S Rao, "Industrial Safety, Health and Environment Management Systems". Createspace Independent Publishing Flat form, 2000.
3	Charles D Reese, "Occupational Safety and Health Fundamental principles and Philosophies", Tailor and Francis Ltd, 2017.

Reference Books:	
1	Sudhakar Paul T Rani, "Occupational Safety and Health", Createspace Independent Publishing Platform, 2018.
2	Rana S P, Goswami P K, and Indu Rathee, "Handbook of Occupational Safety and Industrial Psychology". S. Chand and Company Ltd, 2014.
3	Goetsch D. L., "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall Publishers, 2010.
4	National Building Code of India 2016 – Volume 1

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- The students will have to answer five full questions, selecting one full question from each unit.

Teaching & Learning Process:

Chalk and talk, Power point presentations, Animations and Videos and demonstrational learning

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓		✓						✓
CO2	✓			✓	✓	✓						✓
CO3	✓			✓	✓	✓						✓
CO4	✓			✓		✓	✓					✓

Course Title	**ECOLOGY & ENVIRONMENTAL IMPACT ASSESSMENT**						
Course Code	**21CVT7053**						
Category	**Open Elective Course (OEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:

To foresee the potential environmental problems that would arise out of a proposed development, examine and select the suitable methodology for the various project options and predict significant environmental impact, identify the appropriate abatement and mitigating measures for the implementation of projects.

UNIT – I **8 Hours**

INTRODUCTION TO EIA:

Ecological Factors and Development Activity and, EIA, Rapid and Comprehensive EIA, EIS, FONSI. Need for EIA Studies, Baseline Information, Step-by-step procedures for conducting EIA, Limitations of EIA.

UNIT – II **8 Hours**

METHODOLOGIES OF EIA:

Frame work of Impact Assessment. Developmental Projects- Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies, Techniques of EIA.

UNIT – III **8 Hours**

ENVIRONMENTAL ATTRIBUTES:

Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment. EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

UNIT – IV **8 Hours**

PUBLIC PARTICIPATION PROGRAM :

Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements.

Salient Features of the Project Activity-Environmental Parameter Activity Relationships - Matrices.

UNIT – V **8 Hours**

EIA FOR PROJECTS:

EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

Course Outcomes: The students will be able to	
CO 1	Explain systematic identification and evaluation of the potential impacts of proposed projects on components of the total environment.
CO 2	Apply and identify the measures to be adopted to avoid environmental impact and reinforce a commitment in an organized and systematic approach by involving agencies and public participation.
CO 3	Develop environmental protection mechanism for the proposed projects to protect and restore good environment with sustainable development.

Teaching & Learning Process: Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	Methodologies for Environment Impact Assessment - Anjaneyalu. Y, B S publications.
2	Environment Impact Assessment – N.S. Raman, A.R Gajbhiye and S.R. Khandeshwar, dreamtech press.
3	Environment Impact Assessment – R.R. Barthwal, New Age International Publishers.

Reference Books:	
1	Environmental Impact Analysis-Jain R.K.-Van Nostrand Reinhold Co.
2	Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
3	Environment Impact Assessment - Larry W. Canter - McGraw Hill

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CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	✓					✓	✓					
2		✓				✓				✓		
3	✓						✓		✓		✓	

Course Title	**CONSERVATION OF NATURAL RESOURCES**						
Course Code	**21CVT7054**						
Category	**Professional Elective Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: To learn types of Natural resources and associated problems, comprehend soil as a natural resources types of landforms, soil conservation and sustainable land use planning and understand the availability and distribution of water, discuss biodiversity and its role in ecosystem functioning. Ascertain Social issues, human population and their relation with the Environment.

UNIT – I **8 Hours**

NATURAL RESOURCES:

Renewable and non-renewable resources:

Natural resources and associated problems;

a) Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.
c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.
d) Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers-pesticides problems, water logging and salinity.
e) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

UNIT – II **8 Hours**

ECO SYSTEMS:

Concept of an eco-system, Structure and function of an eco-system, Producers, consumers, decomposers, Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:

a) Forest ecosystem
b) Grass land ecosystem
c) Desert ecosystem.
d) Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT – III **8 Hours**

SOIL:

Soil as a resource, types of lands, conservation of land forms, deforestation and effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.

WATER:

Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Himalayan component, peninsular component, issues involved. Ground water, it's potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

UNIT – IV **8 Hours**

BIODIVERSITY:

Introduction: Definition: Genetic, Species and Ecosystem diversity, Bio Geographical classification of India, Value of Bio Diversity: consumptive use, productive use, social use, ethical use, aesthetic use and option values, Bio Diversity at Global, National and local levels, India as a mega diversity nation, Hot spots of Bio Diversity, Threats to Bio Diversity: Habitat loss, poaching of wild life, man wildlife conflicts, endangered and endemic species of India, conservation of Bio Diversity: in-situ and ex-situ conservation of Bio Diversity, Biological Diversity Act 2002.

UNIT – V **8 Hours**

SOCIAL ISSUES, HUMAN POPULATION, ANIMAL POPULATION & THE ENVIRONMENT:

Social Issues and the Environment: Environment from unsustainable to sustainable development, Urban problems related to energy water conservation, rainwater harvesting, watershed management,

Resettlement and rehabilitation of people: its problems and concerns, case studies

Environmental Ethics: issues and possible solutions, climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and holocaust, case studies, waste land reclamation, consumerism and waste products.

Environment (protection) Act: Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act, Wildlife (protection) Act, Forest (conservation) Act, issues involved in enforcement of environmental legislation, public awareness.

Human Population ,Animal Population and the Environment: Population growth, variation among nations, Population explosion: family welfare program, environment and human health, human rights value education, HIV/AIDS, women and child welfare, role of information technology in environment and human health, case studies.

Course Outcomes: The students will be able to	
CO 1	Identify different types of Natural Resources & associated problems.
CO 2	Comprehend Soil as a resource, types of landforms & understand the availability and distribution of water.
CO 3	Discuss biodiversity and its role in ecosystem functioning.
CO 4	Ascertain Social issues, human population & their relation with the Environment.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	"Irrigation Water Resources and Water Power Engineering", by Modi, P.N, Standard Book House Publishers, New Delhi, 10th Edition, 2019.
2	"Groundwater" by Raghunath H.M, 3rd Edition, New Age International Publishers, New Delhi, 2007.
3	"Geology of India & Burma",by Krishnan, M.S CBS publishers, New Delhi, 6th edition, 2017, ISBN-13 978-8123900124.
4	"A Textbook of Hydrology",by P.Jaya Rami Reddy, Laxmi publications,Pvt Ltd, 3rd edition, 2021.
5	"Biodiversity & Ecosystem function", by E D Schulze & H A Mooney, Springer Publishers, 2nd edition, 1994, ISBN-13 978-3540581031.
6	Human Population & the Environmental crisis, Ben Zuckerman & David Jefferson, Jones & Bartlett Publishers, 1996, ISBN-13 : 086720966-978 2.

Reference Books:	
1	"Irrigation & Drainage Engineering", by Peter Waller & MulunehYitayew, Springer Publishers, 1st edition, 2016, ISBN-13 : 978-3319056982.

2	"Biodiversity & Ecosystem functioning", by Michel Loreau ,Shahid Naeem & Pablo Inchausti, Oxford publishers, 2nd Edition 2002, ISBN-13 : 978-0198515715
3	" Human population & its Influence on Biological Diversity", bu R P Cincotta & L J Gorenflo, Springer Publishers,2011th edition , ISBN-13 : 978-3642267116

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- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination (SEE):

- ✓ Theory SEE will be conducted by institute as per the scheduled timetable, with common question papers for the subject of duration 03 hours.
- ✓ The question paper will have ten questions.
- ✓ Each question is set for 20 marks and there will be 2 questions from each unit / module.
- ✓ Each of the two questions under a unit / module should have a maximum of 3 sub-questions, should have a mix of topics under the Unit/module.
- ✓ The students have to answer 5 full questions. Selecting one full question from each unit / module.

Question paper pattern:

• The question paper will have ten full questions carrying equal marks.
• Each full question will be for 20 marks.
• There will be two full questions (with a maximum of three sub - questions) from each unit.
• Each full question will have sub - question covering all the topics under a unit.
• The students will have to answer five full questions, selecting one full question from each unit.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1		✓				✓	✓					✓
CO 2	✓		✓			✓	✓					
CO 3						✓	✓					✓
CO 4							✓	✓		✓		✓

Course Title	**SUSTAINABLE BUILDING MATERIALS**						
Course Code	**21CVTE7055**						
Category	**Open Elective Course (OEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**40**	**03**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives: The objective of this course is to expose the students to the concepts of sustainability in the context of building and conventional engineered building materials, such as concrete, and achieving the same through lower carbon cements and recycled aggregate and to minimize consumption of natural resources including water. Exposing the student to concepts of embodied, operational and life cycle energy, minimizing energy consumption by optimal design.

UNIT – I **8 Hours**

INTRODUCTION:

Definition and Fundamentals of Sustainability, factors affecting Sustainability, Basics of Carbon Cycle, Factors affecting Carbon Cycle, Greenhouse effect and Global warming, Carbon Footprint of materials.

UNIT – II **8 Hours**

EMBODIED ENERGY:

Embodied energy, operational energy in building and Life cycle energy, Case Study for energy in building. Ecological foot print, Bio-capacity and calculation of planet equivalent.

UNIT – III **8 Hours**

ROLE OF MATERIALS:

Carbon from cement, Alternative fuel for cements for reduction in carbon emission. Alternative cements and cementitious material and their characterization, Strength of concrete with supplementary cementitious material.

UNIT – IV **8 Hours**

SUSTAINABILITY ISSUE AND ALTERNATE CONSTRUCTION MATERIALS:

Sustainability Issues in Cement and Concrete Materials, Role of quality, minimization of natural resource utilization, Reduction in water consumption in concrete, Recycled aggregate, High volume fly ash concrete, Geo-polymer concrete etc.

UNIT – V **8 Hours**

GREEN BUILDING RATING SYSTEMS:

BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age.

Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings.

Course Outcomes: The students will be able to	
CO 1	Understand the concept of sustainability and basics of carbon cycle and global warming due to different materials in construction.
CO 2	Understand the concept of energy efficient construction and embodied energy.
CO 3	Discuss the role of sustainable construction materials and its importance in carbon reduction.
CO 4	Analyse buildings for green rating.

Teaching & Learning Process:
Chalk and talk, Power point presentations, Animations and Videos.

Text Books:	
1	Green Building Materials and Technique, Mr. Vinodh B R and Mrs. Shoba R, ISBN-13 : 979-8889513452, Publisher : Notion Press (18 January 2023).
2	Anastas, P.T. Warner, J.C. Green Chemistry: Theory and Practice, Oxford University Press Inc, New York, 1998
3	Matlack, A.S. Introduction to Green Chemistry Marcel Dekker, New York, NY, 2001

Reference Books:	
1	Design and Control of Concrete Mixtures, Kosmatka, S.H. and Wilson M.L., 16th Edition, Portland Cement Association, 2015
2	Hand Book of Green Chemistry and Technology, by James Clarke and Duncan Macquarrie, Blackwell Publishing.

Process of Assessment (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject /course by securing not less than 35% (36 Marks out of 100) in the Semester End Examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

- ✓ Two Tests each of 20 Marks (duration 01 hour) has been conducted in each semester.
- ✓ First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester.
- ✓ The makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sports etc.) reason.
- ✓ Two assignments each of 05 Marks (taken average at the end).
- ✓ First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.
- ✓ Group discussion /Activities / Seminar / Quiz will be planned suitably to attain the Cos and POs and PSo.
- ✓ At the end of the 13th week of the semester the sum of two tests, two assignments and Group discussion / Activities / Seminar / Quiz will be scaled out of 50 marks.
- ✓ (For each CIE, the portion of the syllabus should not be common / repeated).
- ✓ CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

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CO4	✓	✓				✓	✓					✓