A.Y. 2023-24 (Odd Semester)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information	
Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV301
Course Name	Water Supply and Treatment Technology
Desired Requisites:	Basic hydraulics and Engineering Chemistry

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ESE**	**ISE**	**Total**
Tutorial	-	30	50	20	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To provide the pertinent knowledge on water supply and treatment systems.
2	To impart necessary skill for the design and operation of water treatment units.
3	To prepare students for higher studies and research in the field of water treatment technology.
4	To familiarize the students with latest trends in water treatment.

Course Outcomes (CO) with Bloom's Taxonomy Level

After completion of the course students will able to

CO1	Explain water quality, water supply system and treatment technologies.	Understand
CO2	Analyze and Solve the problems on water related to quality, quantity, conveyance and treatment.	Apply/ Analyse
CO3	Design water treatment units, and pipeline system.	Create

Module	**Module Contents**	**Hours**
I	**Water Demand and Quality** Water supply system: Introduction, Components Water demand: Usage and rates, Governing factors, Variation, Estimation (Present, intermediate and ultimate) Water Quality: Physical, Chemical and biological parameters, IS 10500-2012 Sources: Quantitative and Qualitative study	**6**
II	**Conveyance of water** Source works: Intake (Types and location), Design of river intake, Jack well, Pumping system, Power and capacity of pump Conveyance system: Types (Gravity, gravity fed and pressure), Materials (Ductile Iron, Mild steel and Plastic), Jointing, Laying, Hydraulic testing, Break pressure tank, Design of gravity fed and pressure pipe, Economic design Appurtenances: Valves, Thrust block	**6**
III	**Water treatment (Aeration, Mixing and Settling)** Treatment: Philosophy, Unit processes and operations Aeration: Process, Types of aerator, Design of cascade aerator Coagulation: Physics and chemistry, Practice, Design of rapid mixer Flocculation: Theory, Design of slow mixer (hydraulic and mechanical) Settling: Theory, Types, Design of rectangular and circular clarifiers for type 1 settling, High rate	**8**

IV	**Water treatment (Filtration and Disinfection)** Granular Filtration: Classification, Theory of deep mono and dual bed filter, Components of deep bed filter, Clean filter bed head loss, Filter operation, Design of mono and dual bed filter Disinfection: Types, Ideal and non-ideal disinfectant, Kinetics, Chlorination, Chemistry of chlorination, Chlorine demand, Chlorination practice, UV and Ozone disinfection	**6**
V	**Treatment for TDS removal** Membrane filtration: Types, Basic concepts, Applications Adsorption: Introduction, Basics of Carbon adsorption Ion Exchange: Theory, Design of softener Point of use purifiers, Package drinking water plant, Water plant residual management	**5**
VI	**Water distribution system and Operation-Maintenance** Water distribution: Methods, System configurations, Hydraulic and functional requirements, Hydraulic analysis, Design, Computer applications Service reservoirs: Necessity, Components, Location, Head, and Capacity Concept of 24×7 supply, Leakage: Causes, Detection and Control, Water quality in distribution: Causes of deterioration, Source trace, Water age, Nodal constituent concentration, Operation and maintenance: Water supply system	**9**

Text Books	
1	Modi, P. N., "Water Supply Engineering (Environmental Engineering I)", Standard Book House, 6th Edition, 2018.
2	Raju, B.S.N., "Water Supply and Wastewater Engineering" Tata McGraw Hill Private limited, New Delhi, 2nd Edition, 2000.
3	Garg, S. K. "Water Supply Engineering", Khanna Publishers, 33rd Edition, 2010
References	
1	"Manual on Water Supply and Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 1999.
2	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018
3	Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009.
4	Davis, M, L, and Cornwell, D, A, "Introduction to Environmental Engineering", Tata McGraw Hill Publishing Company, Special Indian Edition, 2010.

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3						2						3	3	
CO2		3					2						3	3	
CO3			3				2						3	3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

ISE: Assignment on real-life problem pertaining to modules 1 to 3 and evaluated by test/quiz/presentation/oral; Field visit to water treatment plants and evaluated by test/quiz/presentation/oral.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV302
Course Name	Soil Mechanics
Desired Requisites:	Fluid mechanics, Solid Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide the knowledge of behaviour of soil under stresses to students
2	To prepare students for competitive examinations and higher studies in the field of geotechnical engineering.

Course Outcomes (CO)

After completion of the course students will able to

CO1	**Explain** soil parameters, **derive** their interrelationships and **classify** the soil based upon them.	Understand Apply
CO2	**Explain** concepts and **solve** problems related to topics of seepage through soil, effective stress in soil and soil compaction	Understand analyse
CO3	**Evaluate** the stiffness of soil using shear strength parameters and ground settlements against time	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction:** Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering, Three-phase system and phase relationships, Determination of various soil parameters in laboratory	6
II	**Soil Classification** Grain size and hydrometer analysis, Plasticity Characteristics of Soil and their determination, Unified and IS soil classification system.	6
III	**Permeability and Seepage :** One dimensional flow, Darcy's law, laboratory methods for determination of co-efficient of permeability, Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping, Principle of effective stress, capillarity, seepage force and quicksand condition.	7
IV	**Compaction of Soils:** Theory of compaction, laboratory determination of optimum moisture content and maximum dry density, Compaction in field: specifications and quality control.	6
V	**Compressibility and Consolidation of soils** Comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy, Interpretation of consolidation test results, Terzaghi's theory of consolidation, Final settlement of soil deposits	7
VI	**Shear Strength of Soils** Mohr-Coulomb failure criterion, Determination of effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.	7

Text Books

1	Gopal Ranjan and Rao A.S.R., "*Basic and Applied Soil Mechanics*", New Age International Publishers, 3rd Edition, 2016
2	Murthy, V. N. S., "*Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series*", CBS publishing; 1st edition, 2018
3	Das B. M., "*Principles of Geotechnical Engineering*", Cengage Learning, 7th Edition
4	Gulhati, S. K. and Datta, M., "*Geotechnical Engineering*", Tata McGraw-Hill, 1st Edition, 2005
References	
1	Robert D. Holtz, William D. Kovacs, Thomas C. Sheahan, *"An Introduction to Geotechnical Engineering",* Pearson, 2nd Edition, 2015
2	Couduto, Donald P. , "*Geotechnical Engineering – Principles and Practices*", Prentice-Hall., 2nd Edition, 2017
3	Budhu M., "*Soil Mechanics and Foundations*", John Wiley & Sons, Inc, 3rd Edition, 2011
Useful Links	
1	https://www.youtube.com/watch?v=Lng0hVDvsu0&list=PLOzRYVm0a65dtbpo_DP7acjsLYdmWT99r
2	https://www.youtube.com/watch?v=V1m3cB-Aqy8&list=PL940DD62E8781E147

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2			1										3
CO2	3	3												3
CO3		3	1											3

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV303
Course Name	Transportation Engineering
Desired Requisites:	Engineering Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To give exposures to highway planning and designing of geometric elements of roads and rails.
2	To comprehend to geometric standards and various practices adopted for construction of roads and rails.
3	To develop skills of construction and maintenance and traffic management of highways and railways.

Course Outcomes (CO) with Bloom's Taxonomy Level

After the completion of the course students will be able to

CO1	**Explain** and **apply** the principles of planning and designing of various geometric elements of highways and railways.	Understand & Apply
CO2	**Apply** knowledge for selection of construction materials and **select** appropriate methods of construction and maintenance for roads and railways.	Apply
CO3	**Analyse and adopt** various techniques for traffic management of highways and railways and assess the geometric standards of pavements.	Analyse & Evaluate

Module	**Module Contents**	**Hours**
I	**Highway Developments** Role and importance of infrastructure development, Various modes of transportation, characteristics and suitability, history of highway engineering, development plans, various organizations involved in highway development, their setups and working, finance options. **Highway Alignment:** basic requirements for an ideal alignment, factors governing highway alignment, highway location surveys and studies.	6
II	**Geometric Design-I:** Cross sectional elements, sight distance, reaction time, analysis of safe sight distance, and analysis of overtaking sight distance, intersection sight distance	6
III	**Geometric Design-II:** Horizontal, vertical and transition curves, super elevation, widening, requirements as per IRC, Basic concepts and methods of pavement design.	7
IV	**Highway Construction:** Materials – Stone aggregates, soil, cement, bitumen properties and their testing. Construction methods for various types of flexible and rigid pavements, Drainage, repairs and maintenance. **Traffic Engineering:** Traffic Surveys, traffic flow and capacity, traffic regulation and control; design of road intersections and parking facilities, Webster method of traffic signal design, Introduction to Traffic Safety	8

V	**Railway Engineering Part I** History, Indian Railways, Permanent Way – components, types, functions, Rails: Coning of wheels and tilting of rails **Geometric Design:** Alignment, Gradients, Horizontal and transition curves, superelevation design, Points and crossings, track junctions, track resistances, tractive effort.	6
VI	**Railway Engineering Part II** **Stations and Yards:** Purpose, location, site selection, types and layouts. **Signalling and Interlocking:** Objectives, types, principle of interlocking, control of train movements. **Construction and Maintenance:** Methods, Materials, special measures for high speed track, maintenance of tracks and traffic operations, Modern trends in railways.	6

Text Books	
1	Bindra S. P., "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Edition 2012.
2	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018
3	Arora S. P. and Saxena S. C., "A Textbook of Railway Engineering", Dhanpat Rai Publications Pvt, Ltd, 7th Edition, 2006.

References	
1	Kadiyalai, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 8th Edition 2013
2	Mundrey J. S., "Railway Track Engineering", Tata McGraw Hills Publications, 4th Edition, 2009.
3	Wright, Paul H. and Dixon, "Highway Engineering", John Wiley & Sons; 7th Edition 2003.

Useful Links	
1	https://nptel.ac.in/courses/105/101/105101087/
2	https://nptel.ac.in/courses/105/101/105101008/
3	https://nptel.ac.in/courses/105/105/105105107/

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		1		1								1	
CO2			3			1							2	1
CO3		3	3	2				1					2	1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE + ISE + ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV304
Course Name	Design of steel Structures
Desired Requisites:	Solid Mechanics & Structural Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To illustrate various design philosophies and concept of plastic analysis.
2	To impart the knowledge of design of various steel members and their connections.
3	To provide knowledge of design practical steel structures such as industrial sheds, steel buildings etc.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Apply the concept of limit state for design of steel structures.	Apply
CO2	Calculate the strength of steel structural members and connections.	Evaluate
CO3	Design steel structures such as industrial sheds, steel buildings etc.	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to steel structures, standard rolled steel sections and their properties and designation, Design philosophies, Types of loads acting on structure, Introduction to IS Codes and specifications: IS 875, IS 800. Introduction to Plastic theory- Plastic hinge concept, Plastic collapse load, Plastic moment, Shape factor, Plastic section modulus.	7
II	**Connections** Types of bolts, bolted and welded connections. Concentric and eccentrically loaded connections, simple connection of bracket plates to columns.	6
III	**Tension and Compression Members** Various types of failures such as yielding of gross area, rupture at critical section and block shear. Design of single and double angle sections. Buckling classification of various sections, Buckling curves, Design of single and double angle struts in trusses,	7
IV	**Beams and Girders** Laterally restrained and unrestrained simply supported beams. Design of compound beams and welded plate girder. Selection of section and positioning of stiffeners, Curtailment of flange plates.	7
V	**Columns and Column Bases** Column subjected to Axial load and biaxial bending, built up column sections, laced and battened columns. Column bases: Design of slab base, gusseted base, moment resisting base, Anchor bolts.	6

VI	**Roofing System** Trusses, Purlins. Dead load, Live load and Wind load calculations. Analysis and design of truss. Connections of truss to column. Introduction to Pre-Engineered Buildings (PEB)- Primary Members / Main Frames, Secondary Members / Cold Formed Members, Roof & Wall Panels.	7

Text Books	
1	Duggal S.K., "Limit state design of steel structures", Tata McGraw-Hill Publications, New Delhi, 2nd Edition, 2014.
2	Shiyekar, M. R., "Limit state design in structural steel", PHI learning Pvt.Ltd Publications 2nd Edition 2013.
3	Subramanian N., "Design of steel structures", Oxford University Press, 2010.
References	
1	Dayaratnam, P., "Design of steel structures", S. Chand Publication, New Delhi, 2008.
2	Englekirk, Robert, "Steel structures: controlling behavior through design", John Wiley and Sons, 2003.
3	Gaylord, Edwin and Gaylord, Charles, "Design of steel structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rdEdition, 2010
4	IS 800-2007 "Code of Practice for General Construction in steel", and IS 875-1987 part 1 to 5; "Code of Practice for Design Loads (other than earthquake) for building structures", Bureau of Indian Standards, New Delhi.
Useful Links	
1	https://archive.nptel.ac.in/courses/105/105/105105162/
2	https://onlinecourses.nptel.ac.in/noc19_ce25/preview

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3												1	1	
CO2		3											2	2	
CO3			3										3	3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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AY 2023-24

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester V
Course Code	6CV351
Course Name	Water Quality Analysis Laboratory
Desired Requisites:	Engineering Chemistry Laboratory and Water Treatment Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Practical	2 h/week	30	30	40	100
Tutorial	-				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide the students hands-on practice for analyzing physical, chemical and bacteriological quality of water.
2	To develop the skills required for applying knowledge to decide the chemical dose requirements.

Course Outcomes (CO)

After completion of the course students will able to

CO1	***Apply*** the analysis techniques to determine the physical, chemical and bacteriological water quality parameters.	Apply
CO2	***Design*** experiment/s to address real-life cases pertinent to water quality.	Design
CO3	***Analyze*** and ***interpret*** the results to assess the quality of water for potability.	Analyse

List of Experiments / Lab Activities

List of Experiments:

1. ***Physical and chemical water quality parameters:***
   a. Electrical conductivity and Total Dissolved Solids
   b. Turbidity and Total Suspended Solids
   c. Calcium
   d. Sulphate
   e. Residual chlorine
   f. Fluoride
   g. Iron and Manganese
2. ***Biological water quality parameter***
   a. Most Probable Number (MPN)
3. ***Application of water quality analysis***
   a. Optimal coagulant dose by jar test
   b. Chlorine demand for surface/groundwater
   c. Efficiency of water purifier (reverse osmosis/resin) for hardness removal.
   d. Assessment of river/bore well water pollution through chloride content.
   e. Efficiency of cascade aerator for dissolved oxygen enhancement.

Text Books

1	Metcalf and Eddy, "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 5th Edition, 2014.
2	Sawyer. C. N. And McCarty. P. L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited, 5th Edition, 2003.

References

1	IS 3025 (Relevant parts), Bureau of Indian Standards.

2	Standard Methods for the Examination of Water and Wastewater, APHA, 23rd Revised Edition, 2017.
Useful Links	
1	https://www.youtube.com/channel/UCXOTUs9n8uhzYzBC8NHeacA

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1				2			1						2		
CO2				2			2						2		
CO3			1	3			2	1		2			2		
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV352
Course Name	Soil Mechanics Laboratory
Desired Requisites:	Soil Mechanics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 h/week				
Interaction	-	**Credits: 1**			

Course Objectives

To develop the skills to find Index properties and engineering properties of soil and the classification of soil.

Course Outcomes (CO)

After completion of the course students will able to

CO1	Determine index properties of soil and Classify soil sample	Understand & Apply
CO2	Determine Engineering properties of soils and interpret the behaviour of soils based upon experimental results data.	Understand & Analyse
CO3	Demonstrate use of MS-Excel for data analysis and interpretation	Understand

List of Experiments / Lab Activities

List of Experiments:

1. Identification and classification of soils by field procedures
2. Determination of specific gravity of soil
3. Particle size distribution - Mechanical sieve analysis
4. Determination of consistency limits and indices
5. Determination of coefficient of permeability by constant and variable head method
6. Determination of MDD and OMC for soil by Standard Proctor compaction test
7. Determination of Field density of soil
8. Demonstration of one-dimensional consolidation test
9. Determination of shear strength parameters of soil by direct/box shear test
10. Determination of Unconfined compression test of soil.
11. Demonstration of triaxial compression/shear test
12. Determination of California Bearing Ratio

Text Books

1	Shamsher P. and Jain P. K., “Engineering Soil Testing”, 4th edition, 1999
2	Beauro of Indian Standards, IS 2720 (Various sections / parts)
3	Sharma R. K., “A Laboratory Manual on Soil Mechanics: Testing and Interpretation” 2016

References

1	Bowles J. E., "Engineering Properties of Soil & Their Measurement", Tata - McGraw-Hill Publishing Co., 4th Edition, 1992.
2	Das B. M. , “Soil Mechanics Laboratory Manual”, 6th edition
3	Lambe T.W., “Soil Testing”, Willey Eastern Ltd., New Delhi, 1st edition, 1978
Useful Links	
1	https://research.iitgn.ac.in/stl/labmanual/
2	https://onlinecourses.nptel.ac.in/noc21_ce54/preview
3	https://smfe-iiith.vlabs.ac.in/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1				3									1	3	
CO2				3									1	3	
CO3					3								2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 13-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 13 to Week 18 Marks Submission at the end of Week 13	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 13-week semester. The actual schedule shall be as per academic calendar.

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV353
Course Name	Highway Materials and Traffic Engineering Laboratory
Desired Requisites:	Highway Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To explain parameters governing the selection of best pavement construction material.
2	To develop ability to assess various properties of highway materials and various practices adopted for construction.
3	To demonstrate the method of design of bituminous mixes for flexible pavement.
4	To give the exposure of various tests adopted on field to characterise the road construction materials and management of traffic.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Apply** practices to examine the properties of road construction material for their use in road construction and to manage the road traffic.	Apply
CO2	**Interpret** the test results of materials and **compare** the values with Indian standard codal provision to decide the suitability of road construction material	Analyse
CO3	**Comprehend** concept of bituminous mix design for flexible pavements.	Understand

List of Experiments / Lab Activities

List of Experiments:

4. Specific Gravity of Bitumen
5. Penetration Test on Bitumen
6. Viscosity of Cutback Bitumen
7. Softening Point of Bitumen
8. Flash and Fire Point of Bitumen
9. Ductility of Bitumen
10. Bituminous Extraction Test
11. Spot Speed Study
12. Intersection Traffic Volume Study
13. Impact and Abrasion test of Aggregate
14. Demonstration of Marshall Stability Test

Text Books

1	Khanna S. K., Justo C. E. G., Veeraragavan A, "Highway Engineering", Nem Chand & Sons, 10th edition, 2018

2	Khanna S. K., Justo C. E. G., Veeraragavan A, " Highway Materials And Pavement Testing", Nem Chand & Sons, 2013
References	
1	IS 1201 to 1220 (1978). “Methods for testing tar and bituminous materials.” Bureau of Indian Standards (BIS), New Delhi, India.
2	IS 73 (2013). “PAVING BITUMEN — SPECIFICATION” Bureau of Indian Standards (BIS), New Delhi, India
3	MORTH Specifications for Road and Bridge Works, Indian Roads Congress (IRC) 5th Revision 2013, New Delhi, India
Useful Links	
1	https://ts-nitk.vlabs.ac.in/List of experiments.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3					1	1			1	
CO2				3					1	1			2	
CO3			3		1				1	1			2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV355
Course Name	Presentation and Report Writing
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 h/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To enhance students' communication skills.
2	To expose students to ethical and professional conduct in technical writing.
3	To provide necessary knowledge to write different types technical reports.

Course Outcomes (CO)

After completion of the course students will able to

CO1	Demonstrate presentation skills.	Apply
CO2	Use of modern tools for effective technical writing.	Apply
CO3	Prepare Engineering and other reports	Create

Lab Activities

1. Standard Practice of technical writing (Ethics, Plagiarism, Citation and Referencing Conventions
2. Presentation on
    a. General Topic (Non-Engineering)
    b. Technical Topic
    c. Case Study
3. Study and presentation on Technical Articles (min. 2) (Research papers from reputed journals)
4. Use of Mendeley Desktop, Grammerly and Quillbot
5. Study of
    a. Detailed project report (DPR) for an engineering project
    b. Research Proposal
6. Preparation Engineering Reports
7. Preparation of Resume and Statement of Purpose (SOP)
8. Study on Ethics, Copyright and Intellectual Property Right

Text Books

1	Anderson P. V. "Technical Communication: A Reader-Centered Approach" CENGAGE , 8th Ed. 2014
2	Turk C. and Kirkman J. "Effective Writing: Improving Scientific, Technical, and Business Communication" Routledge, Chapman & Hall, New York, 2nd edition, 1989
3	

References

1	Smith D., Worthington and Jefferson S. "Technical Writing for Success", 4th edition, CENGAGE, 2017
2	Rhodes M. W. and David R. Topolewski "Writing in Engineering: A Brief Guide"

Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1					2	1		2		3		1		1
CO2					2			2		1		1		
CO3					2	1		2		3		1		1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 13-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 13 to Week 18 Marks Submission at the end of Week 13	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 13-week semester. The actual schedule shall be as per academic calendar.				

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Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV311
Course Name	Professional Elective 1: Remote Sensing and GIS
Desired Requisites:	Surveying, Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Introduce students the necessary knowledge and concepts in the field of RS and GIS and their civil engineering significance. To develop the sense of Applications of Spatial technology among civil engineering students.
2	Introduce the technique of interpreting, classifying and applying various RS and GIS data in Civil Engineering decision making
3	Enable students in decision making to manage the Civil Engineering related spatial problems before preparing and implementing any civil engineering action plans

Course Outcomes (CO) with Bloom's Taxonomy Level

After completion of the course students will able to

CO1	Identify and describe the fundamentals of Remote Sensing and photogrammetry.	Understand
CO2	Demonstrate, Classify and Interpret spatial data to extract maximum information.	Analyse
CO3	Investigate, and generate spatial database.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction of Remote Sensing** Definition and principles of remote sensing, Electromagnetic spectrum and interaction with Earth's surface, Platforms and sensors used in remote sensing, Image acquisition and interpretation, Early history of aerial photography, simple camera, aerial camera, types of aerial photographs , taking vertical aerial photograph and flight planning	4
II	**Remote Sensing Data** Types of remote sensing data (optical, thermal, radar, LiDAR, etc.), Image characteristics and properties, Data formats and preprocessing techniques, Radiometric and geometric corrections	4
III	**Image Interpretation and Analysis** Visual interpretation of images, Digital image processing techniques, Image enhancement and classification, Change detection and time-series analysis	4
IV	**Introduction to GIS** Definition and principles of GIS, Components of a GIS (hardware, software, data, methods), Spatial data models (vector and raster), Coordinate systems and map projections	5
V	**Data Management and Analysis in GIS** Data input, storage, and retrieval, Map design principles, Symbolization and map elements, Map layout and composition	4

VI	**Applications of Remote Sensing and GIS:** Land use and land cover mapping, Environmental monitoring and assessment, Urban planning and management, Natural resource management and conservation	5

Text Books	
1	Reddy M. A., "Remote Sensing & Geographical Information System", BS Publications, Hyderabad, 2002
2	Lillesand T. M. & Kiefer R., "Remote Sensing and Image Interpretation" , John Villey, 1999
3	Longley P. A., Goodchild M. F., David J. Maguire, and David W. Rhind. "Geographic Information Science and Systems"
References	
1	Jensen J. R. "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia, 2003
2	Panda B C, "Principles of Remote Sensing", Viva Books Private Limited, 2002

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2													2	
CO2		2		1	3								2	2	
CO3				1	3									1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

- The assessment is based on MSE, ISE, and ESE.
- MSE shall be typically on modules 1 to 3.
- ISE shall be taken throughout the semester in the form of a teacher's assessment. Mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
- ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
- For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information	
Programme	B. Tech. Civil Engineering
Class, Semester	Third Year B. Tech., Semester V
Course Code	6CV312
Course Name	Professional Elective 1: Plastic and Electronic Waste Management
Desired Requisites:	-

Teaching Scheme		Examination Scheme (Marks)			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives	
1	To provide students with a comprehensive understanding of the environmental and health impacts associated with plastic and e-waste, and the urgency of effective management.
2	To explore policy frameworks, regulations, and initiatives related to plastic and e-waste management, including extended producer responsibility (EPR) programs and circular economy approaches.
3	To acquaint students with the sources, types, and generation patterns of plastic and e-waste, and the challenges associated with their collection, recycling, and disposal.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Explain the environmental and health impacts of plastic and e-waste, and the need for sustainable management practices.	Understand
CO2	Perceive policy frameworks, regulations, and initiatives related to plastic and e-waste management, and propose effective strategies for implementing extended producer responsibility (EPR) programs and promoting circular economy practices.	Understand
CO3	Identify the sources, types, and generation patterns of plastic and e-waste, and the challenges and opportunities in their collection, recycling, and disposal.	Analyse

Module	Module Contents	Hours
I	**Introduction to Plastic and E-Waste Management** Understanding the environmental and health impacts of plastic and e-waste, Overview of the global plastic and e-waste crisis, Introduction to plastic and e-waste management approaches, Policies and regulations related to plastic and e-waste management	4
II	**Plastic Waste Management** Sources and types of plastic waste, Plastic waste collection methods and technologies, Sorting and segregation techniques for plastic waste, Recycling and reprocessing of plastic waste, Innovations and initiatives in plastic waste management	5
III	**E-Waste Generation and Sources** Sources of e-waste: consumer electronics, IT equipment, appliances, etc., Understanding the composition and hazardous components of e-waste, E-waste generation trends and patterns, E-waste collection methods and systems	4
IV	**E-Waste Recycling and Disposal** Recycling technologies for e-waste: dismantling, shredding, and separation, Hazardous substance management in e-waste recycling, Resource recovery from e-waste: precious metals, rare earth elements, etc., E-waste disposal methods: landfilling, incineration, and their environmental impacts	5
V	**Extended Producer Responsibility (EPR) and Policy Framework** Overview of Extended Producer Responsibility (EPR) programs, EPR policies and regulations for plastic and e-waste management, International and national initiatives to promote EPR, Case studies on successful EPR implementation	4
VI	**Circular Economy and Sustainable Practices** Design for sustainability: eco-design and product life extension, Promoting repair, refurbishment, and resale of electronics, Circular economy approaches for plastic and	4

	e-waste management, Future trends and innovations in circular economy practices	
Textbooks		
1	Chandrappa R. and Das D. B, "Solid Waste Management: Principles and Practice" 2012	
2	Tchobanoglous G., Theisen H., Vigil S. “Integrated Solid Waste Management”, 2014	
3	Subramanian M. N. “Plastics Waste Management: Processing and Disposal”, Wiley publications, 2nd Edition, 2019	
References		
1	Pope K. “Global Waste Management: Models for Tackling the International Waste Crisis”, Kogan Page publishing, 1st Edition, 2020	
2	Williams E., Hieronymi K., Kahhat R. “E-waste Management From Waste to Resource”, Tayler and Francis, 2012.	
3	Letcher T. “Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions”, Academic Press Inc. 2020.	
Useful Links		
1	https://www.youtube.com/watch?v=_r5rHyMHKEg&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-	
2	https://www.youtube.com/watch?v=sF7NhoIp1C8&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-&index=11	
3	https://www.youtube.com/watch?v=VjKRPOUMu-8&list=PLbRMhDVUMngcUlCNSaynDVY7T1XFaMFFy&index=5	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3	3							
CO2	1					3	3						1	
CO3	2					3	3						1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester V
Course Code	6CV313
Course Name	Professional Elective 1: Air and Noise Pollution Control
Desired Requisites	Engineering Physics, Environmental Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives

1	To provide knowledge on physics of atmosphere, meteorology and its relation to air pollution, different types of air pollution control equipment.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	***Recognize*** and ***summarize*** scientific and engineering principles for air pollution studies	Understand
CO2	***Apply*** appropriate dispersion models ***estimate*** air pollutant concentrations	Apply Evaluate
CO3	***Analyze*** situations leading to air pollution and ***design*** air pollution control strategies with due consideration to technical, environmental, health, safety and social considerations	Analyze Evaluae

Module	**Module Contents**	**Hrs**
I	**Air pollution: A retrospective** Air pollution: sources and types and effects on biosphere, National and international air emission standards; Air Quality Index (AQI)	3
II	**Meteorology** Physics of atmosphere, Solar radiation, Wind circulation, Lapse rate, Inversion, Stability conditions, Pasquil stability model, Maximum mixing depth, Wind rose, Plume behaviour, Global effects of air pollution: Green house effects, acid rain and ozone layer depletion, Heat island effect, Visibility, Photochemical reaction	5
III	**Dispersion of pollutants in the atmosphere** Eddy diffusion model, the Gaussian dispersion model, Point source, Line source, Maximum ground level concentration, Determination of stack height, Sampling time corrections, Effects of inversion trap	4
IV	**Control of Air Pollution** Control Equipment for Particulate Matter: Operation design and component detailing of Settling chamber, Cyclone, Wet collectors, Fabric filter, and Electrostatic precipitator	5
V	**Motor Vehicle Emissions** Automobile Source Emission of pollutants from automobiles, Photochemical smog, Reduction of emissions by different methods	4
VI	**Noise Pollution** Basics of acoustics and specification of sound; Sound power, Sound intensity and sound pressure levels; Plane, Point and line sources, Multiple sources; Outdoor and indoor noise propagation; Psycho-acoustics and noise criteria, Effects of noise on health, Annoyance rating schemes; Noise standards and limit values; Noise instrumentation and monitoring procedure. Noise indices.	5

Textbooks	
1	Wark and Warner, “Air Pollution”, C.F., H.R. Publication, 1st Edition, 1978.
2	Nevers N., "Air Pollution Control Engineering" McGraw-Hill, New York, 2nd edition, 1995.
3	Martin Crawford, “Air Pollution and Control”, Tata McGraw Hill Publication, 1st Edition, 1976.
References	
1	Richard W. Boubel and Bruce Turner, "Fundamentals of Air Pollution", Academic Press, New York, Third edition, 1994.
2	Stern A. C., “Air Pollution Vol. I and II”, Allied Publishers Limited, 1st Edition, 1994.
3	Rao H.V.N. and Rao M. N., "Air Pollution", Tata McGraw Hill, 1st Edition, 1989.
4	Cunniff PE, “Environmental Noise Pollution”, McGraw Hill, New York, 1987.

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2						3							
CO2		2					3							
CO3			2			3	3							

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV314
Course Name	Professional Elective 1: River Engineering
Desired Requisites:	Open Chanel Hydraulics and Water Resources Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0 Hrs/week	30	20	50	100
		Credits: 2			

Course Objectives

1	To provide the student fundamentals of fluvial geomorphology
2	To expose to concept of analysis of river flow hydraulics, hydraulic geometry and stable alluvial channels and fluvial design for river bank protection
3	To prepare the students for higher studies and research in the field of river engineering.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	*Explain* the fundamentals of fluvial geomorphology.	Understand
CO2	*Apply* the knowledge of fundamental of analysis of river flow hydraulics, and hydraulic geometry for stable alluvial channels.	Apply, Analyse
CO3	*Design* of fluvial stable alluvial channels and river bank protection work.	Evaluate

Module	**Module Contents**	**Hours**
I	Fluvial Geomorphology: Fluvial system, variables for alluvial rivers, regime concept, river classifications, thresholds of river morphology, hydraulic geometry, meander platform, geomorphic analysis of river channel responses.	4
II	Foundation of Fluvial Process: Hydraulics of flow in river channel, physical properties of sediments, scour criteria and scour-related problems, alluvial bed forms and flow resistance, sediment movements in Rivers, flow in curved channels.	5
III	Regime Rivers and Responses: Analytical basis for hydraulic geometry, design of stable alluvial channel,	5
IV	Analytical river morphology, plan geometry and processes of river meanders	4
V	Modeling of river channel changes: Mathematical model for erodible channels	4
VI	Gradual breach morphology tidal responses of river and delta system, fluvial design of river bank protection	4

Textbooks

1	Howard C. H., "Fluvial Processes in River Engineering", John Wiley & Sons, 1988.
2	Kumar S, "River Engineering", Khanna Publishing House; 1st edition, 2020
3	Gupta K D, "River Engineering", Vayu Education Of India Edition, First Edition, 2014.

References

1	Kumar D.S., "Practical River And Canal Engineering", Read Books, 2011.
2	US Army Corps of Engineers "Engineering and Design: River Hydraulics (Engineer Manual 1110-2-1416)", Khanna Publishers, New Delhi, 8th Edition, 1993.

Useful Links	
1	
2	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		3											2	2
CO3			3										3	2
1: Low, 2: Medium, 3: High														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 2 and 60% weightage on modules 3 to 4. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV315
Course Name	Professional Elective 1: Advanced Surveying
Desired Requisites:	Engineering Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To understand advanced surveying techniques and geospatial techniques.
2	To develop an ability to analyze land profiles in logical manner and will be able to apply well understood principles in planning and design of engineering structures on the Earth's surface.
3	To adopt suitable survey technique and select equipment based on the required level of accuracy and prevailing field conditions

Course Outcomes (CO)

CO1	**Study** modern surveying equipment effectively to improve quality of surveys.	Understand
CO2	**Analyze** and synthesize data from the aerial photographs and remote sensing images to prepare thematic maps.	Analyze
CO3	**Analyze and Solve** surveying problems by using remote sensing, GIS and GPS.	Analyze & Apply

Module	**Module Contents**	**Hours**
I	**Geodetic Surveying** Principles, Classification if triangulation systems, Selection of stations, Signals and towers, Baseline measurement and correction, Extension of base, base net, Satellite station, Reduction to center, Introduction to theory of errors and technical terms.	5
II	**Total Station Survey** Principle, Data observations, Software	5
III	**Aerial Photogrammetry** Aerial Photogrammetry, Basic concepts, Geometry of vertical photographs, Scale and Flying height, Relief displacement, Flight planning computations, Stereoscopy and Parallax, Photo mosaic, Elements of photo interpretation.	5
IV	**Remote Sensing** Concepts and foundations of remote sensing, Characteristics of Remote sensing satellites and sensors	5
V	**GIS** Overview of GIS, data input and output, data management.	3
VI	**GPS** Introduction to GPS, Geodesy, Working principle of GPS, Measurement and mapping techniques.	3

Text Books

1	Chandra A.M., Higher Surveying, New Age International Private Limited, 2015
2	Arora K. R. "Surveying", Vol. 1 & 2, Standard Book House, 16th edition, 2018.
3	Agrawal N.K., "Essentials of GPS" Spatial Network Pvt. Ltd., Hydrabad1997.

References	
1	James Anderson and Edward Mikhail, Surveying: Theory and Practice, McGraw Hill Education; 7th edition, 2017
2	Lillesand T. M. and Kiefer. R.W., "Remote Sensing and Image Interpretation", 4th Edition, John Wiley and Sons, New York, 2002
3	R. E. Davis, F. Foote and J. Kelly, "Surveying; Theory and Practice", McGraw Hill Book Company, New York.
Useful Links	
1	

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3				2								1		
CO2		2											1		
CO3		1													
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	6CV316
Course Name	Professional Elective 1: Structural Mechanics
Desired Requisites:	Solid Mechanics, Structural Analysis

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To explain the concept of matrix methods of structural analysis.
2	To inculcate applications of flexibility and stiffness methods to solve indeterminate structures.
3	To illustrate the concept and applications of finite element method in structural engineering.

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	**Apply** the concepts of matrix methods of structural analysis.	Applying
CO2	**Analyse** indeterminate structures by using structure oriented and element approach.	Analysing
CO3	**Calculate** the nodal displacements and member forces by using finite element method.	Evaluating

Module	**Module Contents**	**Hours**
I	**Flexibility Method- Beams & Frames** Flexibility coefficient matrix, Compatibility conditions, Development of flexibility matrix equations, Analysis of indeterminate beams and rigid jointed frames by using flexibility method.	5
II	**Flexibility Method- Trusses** Analysis of indeterminate trusses by using flexibility method, Stresses due to lack of fit or error in length, Temperature stresses.	4
III	**Stiffness Method- Structure Approach** Stiffness coefficient matrix, Relation between flexibility and stiffness coefficient matrix, Development of stiffness matrix equilibrium equations, Analysis of continuous beams and frames.	5
IV	**Stiffness Method–Element Approach: Beams & Frames** Formulation for element stiffness matrix for beam element and plane frame element, Local and global coordinates, Transformation of matrices, Analysis of continuous beams and frames by using direct stiffness method.	5
V	**Stiffness Method–Element Approach: Trusses** Direct stiffness method- Element approach, Development of element stiffness matrix and nodal load vector for truss element, Analysis of trusses.	5
VI	**Finite Element Method** Introduction finite element method, Basic concept, General procedure of finite element analysis, Discretization, nodes, element incidences, displacement model, shape function, selection of order of polynomials, Principle of minimum potential energy, variational principle, Development of element stiffness matrix and nodal load vector for bar element, Applications to bars with constant and variable cross sections subjected to axial forces.	5

Text Books	
1	Gere, J. M. & Weaver, W., “Matrix Analysis of Framed Structures”, CBS Publishers and Distributor, 2nd Edition, 2004.
2	Godbole, P. N., “Introduction to Finite Element Methods”, I K International Publishing House Pvt. Ltd., 1st Edition, 2013.
3	Reddy, C. S., “Basic Structural Analysis”, McGraw Hill Education, 3rd edition, 2017.
References	
1	Cook, Robert D., Malkus, David S., Plesha, Michael E., and Witt, Robert J., “Concepts and Applications of Finite Element Analysis”, 2003.
2	McGuire, William, Gallaghar, Richard H. and Ziemian, Ronald D., "Matrix Structural Analysis", John Wiley, 2nd Edition, 2000.
3	Meghare A. S. and Deshmukh S. K., “Matrix Methods of Structural Analysis” Charotar Publishing House, 2nd Edition, 2016.
Useful Links	
1	https://nptel.ac.in
2	https://nptel.ac.in/content/syllabus_pdf/105105180.pdf
3	https://onlinecourses.nptel.ac.in/noc20_me91/preview
4	HoD Applied Mechanics - YouTube

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3													3	
CO2		3												2	
CO3			3		2									1	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher‘s assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV317
Course Name	Professional Elective 1: Advanced Concrete Technology
Desired Requisites:	Concrete Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to in depth knowledge and concepts of the manufacturing of cement and hydration of cement.
2	To provide conceptual knowhow of admixtures used in concrete to improve properties of concrete and develop skills to design concrete mixtures.
3	To make students conversant with durability issues of concrete and special types of concrete.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Perceive and Apply the knowledge cement, concrete and admixtures to fulfil the requirement of construction industries.	Understand & Apply
CO2	Demonstrate and analyse durability of issues of concrete and apply knowledge special concretes.	Understand & Analyze
CO3	Design a concrete mixes according to construction industries requirements.	Design

Module	**Module Contents**	**Hours**
I	**Cement** Clinkering reactions, Hydration Reactions & Chemistry of Cement paste, Setting of Cements, Heat of Hydration, Microstructure of hydrated cement paste.	5
II	**Admixtures in Concrete - I** Specification, Functions, Classification and Working principles. Chemical Admixtures: Plasticizers, Super-plasticizer, Accelerators, Retarders, Air entraining agents, Speciality Admixture, Compatibility of Admixtures	4
III	**Admixtures in Concrete - II** Specification, Functions, and Classification. Mineral Admixtures: Fly ash, Silica Fume, Slag, Rice husk ash, Metakaolin Pozzolanic Reactivity of Mineral admixtures	4
IV	**Concrete Mix Design** Factors to be considered, Concrete mix design of High Strength Concrete and SCC by IS: 10262 (2019) method, Concept of Particle Packing density, Statistical quality control	5
V	**Special Concretes:** Fibre reinforced concrete, Ultra-high strength concrete and Pervious Concrete. Fresh Properties of Self Compacting Concrete	3
VI	**Durability of Concrete** Permeability and Pore Structure, Ionic Diffusion, Chemical Attack (Sulphate, Chloride, acid, leaching, Carbonation), Physical Attack (freeze-thaw), Corrosion of reinforcement, Alkali-Aggregate Reaction	5

Text Books

1	Mehta P. K. and Paulo J. M. M, "Concrete – Microstructure, Properties and Material", McGraw Hill Professional 3rd Edition, 2009.
2	Neville A. M. and Brooks J. J., "Concrete Technology", Pearson Education Limited, 1987
3	Shetty M. S., "Concrete Technology", S. Chand & Company Ltd. New Delhi, 7th Edition, 2013.
References	
1	Neville A. M., "Properties of Concrete", Prentice Hall, 5th edition, 2012
2	Newman J., Choo B.S., Advanced Concrete Technology-Constituent Materials, Elsevier Ltd. 1st edition, 2003
3	Taylor H.F.W., Cement chemistry, Thomas Telford, 2nd edition, 1997
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105102012/L01.html
2	https://www.digimat.in/nptel/courses/video/105104030/L01.html
3	https://www.digimat.in/nptel/courses/video/105106176/L01.html

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	2
CO2		3											2	2
CO3			3										2	2

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE + ISE + ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6CV318
Course Name	Professional Elective 1: Airport Engineering
Desired Requisites:	Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to airport construction and maintenance aspects of airport and make familiar with components of airport.
2	Impart the techniques of planning and designing of the airport components like runways,taxiways, terminal building, hangars etc. along with the drainage and traffic controls methods.
3	To make conversant with various construction methods of airport.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Demonstrate the knowledge required for planning and designing of various components of airports.	Understand
CO2	Explain and Apply design considerations of the various components of airports.	Understand & Apply
CO3	Compare and apply various techniques used in the construction of airports and Analyze professional practices for solving problems in the field of airport engineering.	Understand & Analyze

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Airport Engineering** Introduction, History, Terminology, characteristics,airport classification, and organizations concerned with Airport Engineering, components of aircraft, Role of civil engineering in airport planning and design.	5
II	**Module 2: Planning** Factors influencing site selection for airports, Land use planning and zoning regulations, Runway orientation and site-specific considerations, Safety considerations and clearance requirements, airport obstructions, layouts, zoning laws.	5
III	**Module 3 : Geometric Design of Runways, Taxiways** Designing: Runways, Runway classification, Runways-orientation, basic runway length, geometric design.Taxiways- layouts, geometric design.	4
IV	**Module 4 : Terminal Buildings of Airport** **Terminal Buildings:** Site selection, facilities, aprons, gate positions. Hangars: Function, types, requirements.	4

V	**Module 5: Air Traffic Control System** Air Traffic Control: VFR, IFR, visual aids, lighting and marking. Heliports: Characteristics, site selection, planning, size, obstructions, orientation, marking and lighting.	4
VI	**Module 6: Airport Drainage and Environmental Considerations** Surface water management at airports, Drainage: Necessity, types. Environmental impacts of airports and mitigation measures.	4

Text Books	
1	Robert M. Horonjeff, Francis X. McKelvey, William J. Sproule, and Seth Young "Planning and Design of Airports".
2	Khanna S. K. & Arora M. G., "Airport Planning and Design", Nem Chand and Brothers, 6th Edition, 2012.
3	Surinder Singh "Airport Engineering: Planning, Design, and Operations".5th Edition, 2015.
References	
1	Richard de Neufville, Amedeo Odoni, " Airport System: Planning, Design and Management",Mc Graw Hill Education
2	Horonjeff R., McKelvey F., Sproule W., Young S., "Planning and Design of Airports", McGraw Hill Professional, 5th Edition, 2010.

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												3	2
CO2	3		1										3	2
CO3	3	3	1										3	2

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B. Tech. (Other than Civil Engg.)
Class, Semester	Third Year, Semester II
Course Code	6OE301
Course Name	Open Elective 1-Building Planning and Construction
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		Credits: 3			

Course Objectives	
1	To impart Necessary knowledge and concepts in Building Planning and functional design.
2	To impart Necessary knowledge and concepts in the utilization of building materials, their properties and their applications in construction of building.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Grasp the principles of planning, building bye laws to apply in the planning of residential/public buildings in relation to functional planning.	Understand
CO2	Classify the various components and their relationships in buildings and identify the materials and building services to be adopted for different buildings.	Apply

Module	**Module Contents**	**Hours**
I	**Site, Building and Building Drawings** Categories of buildings, Types of Residential buildings, Site selection, Factors influencing selection of site, guidelines for planning and drawing of buildings, Positions of various building components, types of drawings and relevant scales.	6
II	**Principles of Building Planning and Building Bye laws** Principles of planning: Aspects, prospect, Privacy, Furniture, Roominess, Grouping, Circulation, Sanitation, Lighting, Ventilation, Flexibility, Elegance, Sanitation, Economy. Bye laws: Minimum plot size, building frontage, open spaces, standard dimensions in buildings, Provision for light & ventilation, FSI, Height of Building.	7
III	**Planning concepts in Buildings** Requirements in different types of buildings, Integrated approach to planning in various aspects like aesthetics, landscape, interior, etc. Guidelines for planning & drawing residential and public buildings.	6
IV	**Components of building** Sub structure, Foundations, Bearing Capacity of Soils, Types of Shallow and Deep foundations, Conditions for their applications, masonry, Bonds, Doors, Windows, Staircases, Roofs and Floors, Flooring and their Applications	7
V	**Construction Materials**	7

	Types, Engineering properties and Uses of Bricks, Stones, Aggregate, Lime, Cement, Steel, Aluminium, PVC, Glass. Concrete: Ingredients, Preparation, Properties of concrete, Types of concrete and their applications	
VI	**Building Services and Finishes** Plumbing services for water supply, plumbing services for drainage, symbols, Electrification, symbols of electrical fixtures, Types of Plastering and Pointing, Defects, Paints and Varnishes Types, Application, Methodology on various surfaces, Defects.	7

Textbooks	
1	R.K.Rajput S. 'Building Materials' S. Chand Publications.
2	Bindra and Arora, "Building Construction", Dhanpat Rai and Sons
3	Kumarswamy and Kameshwar Rao., "Building Planning and Design," Tata McGraw Hill Pvt. ltd, 1995.
4	Civil Engineering Drawing - V. B. Sikka, S. K. Kataria and Sons.

References	
1	Punmia, Jain, Jain, "Building Construction", Laxmi Publications ltd. 2005
2	Mantri Institute's 'The A to Z of Practical Building Construction and its Management' Mantri Institute of Devp. and Research. Pune, 1994.
3	Building drawing with Integrated approach – Shah, Kale & Patki, Tata Mc Graw Hill Pub.
4	National Building Code of India and SP- 7.

Useful Links	
1	https://www.youtube.com/watch?v=pYLKA4YQMyI&list=PL46yD-wnVQqxZ8f-_g1PZaFjJIxnJWyFE
2	https://www.youtube.com/watch?v=4kLXfCGB_RI&list=PL46yD-wnVQqxZ8f-_g1PZaFjJIxnJWyFE&index=5
3	https://www.youtube.com/watch?v=2tb1heySCx0
4	https://www.youtube.com/watch?v=Y0Y8zuETHOQ

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2	2												1	

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6OE302
Course Name	Open Elective 1: Disaster Management
Desired Requisites:	B. Tech. (Civil Engineering)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To provide students with necessary knowledge in understanding Disasters, Man-made Hazards and Vulnerabilities.
2	To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
3	To develop rudimentary ability to respond to their surroundings with potential disaster response in areas.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Explain disasters, man-made hazards and vulnerabilities.	Understand
CO2	Apply knowledge to develop effective communication skills for providing information, warnings, and raising public awareness about disaster risks.	Apply
CO3	Assess vulnerability and various methods of risk reduction measures.	Evaluate

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Disaster Management** Definition, scope, and objectives of disaster management, Types of disasters (natural and man-made): – Earthquake, Landslide, Flood, Drought, Fire, and their characteristics, Historical perspectives on disasters and lessons learned.	6
II	**Module 2: Disaster Risk Assessment and Management** Understanding disaster risk and vulnerability, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Hazard identification, mapping, and assessment techniques, Risk analysis and risk reduction strategies, Land-use planning and zoning.	7
III	**Module 3: Disaster Response and Recovery** Incident command systems and emergency operations centers, Search and rescue operations, medical response and triage, Temporary sheltering and logistics.	6
IV	**Module 4: Mitigation and Resilience** Structural and non-structural measures for disaster mitigation, Community-based disaster risk reduction, Climate change adaptation strategies, Post-disaster reconstruction and recovery planning.	7
V	**Module 5: Technology and Innovation in Disaster Management** Geospatial technologies and remote sensing applications. Information management systems and decision support tools. Use of drones, mobile applications, and social media in emergencies.	7

VI	**Module 6: Case Studies and Field Works** Land Slide, Earthquake, Drought, Storm, Flood, Forest fire, Space Based Inputs for Disaster Mitigation, Management and field works related to disaster management.	6

Textbooks	
1	Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2	Bhattacharya Tushar, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
References	
1	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2	Karlene Roberts and Donald D. H. Chávez "Disaster Risk Management: Systems Analysis and Tools"
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						2								
CO2						2								
CO3						2								

Assessment
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