DEPARTMENT OF TECHNOLOGY
THIRD YEAR B.TECH
Civil Engineering
Scheme of Teaching and Examination
Semester – V

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing #	Scheme	Max. marks	Min. Passing
*CE 311	Design of Steel Structures	03	01	-	04	CIE	50	20	IOE	50	20
						SEE	50	20	--------	-------	--------
CE 312	Transportation Engineering –I	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
CE 313	Geotechnical Engineering- I	03	01	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
CE 314	Environmental Engineering-I	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
CE 315	Construction Management	04	-	-	04	CIE	50	20	--------	-------	---------
						SEE	50	20	--------	-------	---------
CEL316	Lab-I Transportation Engineering –I	-	-	02	01	--------	-------	--------	EPE	50	20
CEL317	Lab-II Geotechnical Engineering- I	-	-	02	01	--------	-------	--------	EPE	50	20
CEL 318	Lab-III Environmental Engineering-I	-	-	02	01	------	-------	--------	EPE	50	20
CE 319	Seminar	-	-	02	01	--------	-------	--------	IPE	50	20
CE 320	Internship-I	-	-	-	01	----------	--------	--------	IOE	50	20
	Total	**18**	**02**	**08**	**25**	--------	**500**	--------	--------	**300**	--------
	Audit Course										
AC 330	Introduction to Foreign Language	2	-	-	-----	Institute/ Departmental Level	100	20	--------	--------	--------

Total Credits: 25
Total Contact Hours/Week: 30 hrs
Note:
 #: Minimum 40% marks required in CIE to become eligible for SEE.
• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.
* Theory paper will be of 4 hours.
  CIE – Continuous Internal Evaluation,   SEE – Semester End Examination,
IPE – Internal Practical Evaluation,   EPE–External Practical Examination,
IOE– Internal Oral Evaluation,   EOE–External Oral Examination

DEPARTMENT OF TECHNOLOGY

Shivaji University, Kolhapur, Maharashtra State, India

THIRD YEAR B.TECH
Civil Engineering
Scheme of Teaching and Examination
Semester – VI

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
		L	T	P	Credits	Theory			Practical		
						Scheme	Max. marks	Min. Passing #	Scheme	Max. marks	Min. Passing
CE 321	Theory of structures -II	04	01	-	05	CIE	50	20	IOE	50	20
						SEE	50	20	--------	-------	--------
CE 322	Water Resource Engineering -I	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
CE 323	Transportation Engineering –II	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
CE 324	Environmental Engineering-II	04	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
CE 325	Geotechnical Engineering- II	03	01	-	04	CIE	50	20	--------	-------	---------
						SEE	50	20	--------	-------	---------
CEL326	Lab-I Geotechnical Engineering- II	-	-	02	01	--------	-------	--------	EOE	50	20
CEL327	Lab-II Environmental Engineering-II	-	-	02	01	--------	-------	--------	EPE	50	20
CEL328	Lab-III Structural Design Drawing-I	-	-	02	01	--------	------	-------	IOE	50	20
									EOE	50	20
CE 329	Mini Project	-	-	02	01	--------	-------	--------	IPE	50	20
	Total	19	02	08	25	--------	**500**	--------	--------	**300**	--------
Audit Course											
AC 331	Research Methodology	2	-	-	-	Institute/ Departmental Level	100	20	--------	--------	--------

Total Credits: 25
Total Contact Hours/Week: 31hrs
Note:

 #: Minimum 40% marks required in CIE to become eligible for SEE.

• Tutorials and practical shall be conducted in batches with batch strength not exceeding 18 students.

* Theory paper will be of 4 hours.

  CIE – Continuous Internal Evaluation,   SEE – Semester End Examination,
IPE – Internal Practical Evaluation,   EPE–External Practical Examination,
IOE– Internal Oral Evaluation,   EOE–External Oral Examination

Shivaji University, Kolhapur, Maharashtra State, India

Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part I, Sem V**				
Course Title	:	**Design of Steel Structures**		*Course Code*:	:	**CE 311**
Teaching Scheme (Hours)	:	3 hours/weeks = 3x 13 weeks= 39 hrs minimum		*Total Credits*	:	***03+ 01 +00 =04***
		Tutorial= 01hr/week				
		Practical= ---/week				
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50	IPE : IOE : EPE/EOE : +50 = 150	*Duration of SEE*	:	4 hrs
Revision:	:	**Second**		*Month*	:	*December 2017*

Pre-requisites	:	

The prerequisite for this course is to possess the fundamental knowledge of material properties, calculation of shear force and bending moment and analysis of truss.

Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.

Course Objectives:

1. To understand the use of IS Codes related to structural design of steel structures
2. To understand the concept of limit state method
3. To design of bolted and welded connections
4. To design of tension and compression members of steel structures, columns and column bases
5. To design of beam and plate girder
6. To prepare detailed structural drawings of a steel structure

Course Outcomes:

1. Understand the use of IS Codes related to structural design of steel structures
2. Understand the concept of limit state method
3. Design of bolted and welded connections
4. Design of tension and compression members of steel structures, columns and column bases
5. Design of beam and plate girder
6. Prepare detailed structural drawings of a steel structure

Curriculum Content	**Hours**

UNIT 1 Introduction to structural design, Structural systems, Roll of the designer, Advantages of steel as a structural material, Types of structural steel, Mechanical properties of steel, various rolled steel sections (including cold-formed sections, structural pipe (tubes) sections and their properties. Codes and specifications. Design philosophies, Limit state method.	**4**
UNIT 2 i) Bolted connections: Behavior of bolted joints. Design strength of ordinary black bolts, Design strength of ordinary black bolts, Design of simple connections, Beam to beam, beam to column, framed connections. ii) Welded connections: Types and properties of welds, Types of joints, Effective areas of welds, Design of simple connections, Beam to beam, beam to column, framed connections.	**7**
UNIT 3 Design of Tension members: Types of tension members, Slenderness ratio, Behavior of tension members, Modes of failure, Design of angle sections for tension.	**6**
UNIT 4 Design of Compression Members: Behavior of compression members, Modes of failure, Classification of cross section, Effective length of compression members, Design strength, Compression members in trusses, Design of columns subjected to axial loads, Laced and Battened columns. Column bases: Slab base and Gusseted base.	**10**
UNIT 5 Design of beams: Laterally restrained and unrestrained simply-supported beams. Design of compound beams. Curtailment of flange plates.Design of Gantry girder	**6**
UNIT 6 Design of Roofing for an industrial building: Roofing materials, Types of trusses, Loading on roof trusses, Analysis of trusses, Design of various members of roof trusses.	**6**

Text Books	**:**	

1. Duggal S. K., "Design of Steel Structures", Tata Mc Graw Hill Publishing CompanyLtd., New Delhi, 2008, 3rd Edition.
2. Bhavikatti S.S., "Design of Steel Structures by Limit State Method", I.K International Publishing House Pvt. Ltd.

Reference Books	**:**	

1. Arya A.S. and Ajamani J.L., "Design of Steel Structures", Nemchand and Brothers, Roorkee, 1996, 2nd Edition.
2. Dayaratnam, "Design of Steel Structures", Wheeler Publishing, New Delhi, 2006, 3rd Edition.

3. Gaylord E.H. and Gaylord C.N., "Design of Steel Structures", Mc Graw Hill, New York, 2008, 3rd Edition.

4. Lothers J. E., "Design in Structural Steel Vol-I", Prentice Hall New Jersy.

5. Punmia B.C., Jain & Jain, "Design of Steel Structures", Laxmi Publication, New Delhi, 2008, 2ndEdtion.

6. Ram Chandra, "Design of Steel Structures, Vol - I & Vol – II", Standard Book House,New Delhi, 2007, 2nd Edition.

7. Subramanian N., "Design of Steel Structures", Oxford University Press, New Delhi, 2008, 2nd Edition.

8. Vazirani&Ratwani, "Design of Steel Structures", Mc Graw Hill, New York, 2000, 2nd Edition.

9. Salmon C.G. and JohnsonJ.E., "Steel Structures: Design and Behaviour", Harper and Row, New York, 1995.

10. "Teaching Resource in Design of Steel Structures", IIT Madras, SERC Madras, Anna Univ., NSDAG, 2007.

Reference Codes	**:**	

1. IS: 800 - 2007, Indian Standard code of Practice for use of structural steel in general building construction, BIS – New Delhi (Third Revision).

2. IS: 875 (Part 1) (1987, Reaffirmed 2008): Code of Practicefor Design Loads (Other Than Earthquake) For Buildings and Structures. Part 1: Dead Loads -Unit Weights of Building Materials and Stored Materials (Second Revision).

3. IS: 875 (Part 2) (1987, Reaffirmed 2008): Code of Practicefor Design Loads (Other Than Earthquake) For Buildings and Structures. Part 2: Imposed Loads (Second Revision).

4. IS: 875 (Part 3) (1987): Code of Practice for Design Loads(Other Than Earthquake) For Buildings and Structures. Part3: Wind Loads (Second Revision).

5. IS Handbook No. 1- Properties of structural Steel Rolled Section.

6. Steel Table

   ***Tutorials should be conducted on the basis of solution of design problems.

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Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part I, Sem V**				
Course Title	:	**Transportation Engineering-I**		*Course Code*:	:	**CE 312**
Teaching Scheme (Hours)	:	4 hours/weeks = 4 x 13 weeks= 52 hrs minimum		*Total Credits*	:	***04+ 00 +01 =05***
		Tutorial= 00hr/week				
		Practical= 02hr/week				
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50	IPE : IOE : EPE/EOE : +50=150	*Duration of SEE*	:	**3 hrs**
Revision:	:	**Second**		*Month*	:	***December 2017***

Shivaji University, Kolhapur, Maharashtra State, India

Pre-requisites	:	Geotechnical Engineering.
The prerequisite for this course is to possess the fundamental knowledge of highway engineering and planning, Highway material properties, bridge engineering, airport engineering.		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester

End Examination.

Course Objectives:

1. To familiarize students with sub-branches of Transportation Engineering such as highway engineering, bridge engineering and airport engineering.
2. To make students learn various terminologies related with highway engineering, bridge engineering and airport engineering.
3.To study the various components involved in highway engineering, bridge engineering and airport engineering.
4. To understand the planning aspect involved in highway engineering, bridge engineering and airport engineering.

Course Outcomes:

7. Understand concepts and planning of highway engineering and highway safety.
8. Understand the concepts and analysis of highway geometric design.
9. Understand the principles and design of rigid and flexible pavements.
10. Decide the selection of a bridge structures; list the factors affecting,design of a various parameters of bridge structures.
11. Design and plan airport, runways terminals buildings, hangers and aprons.

Curriculum Content	Hours
HIGHWAY ENGINEERING **UNIT 1** Introduction Scope of highway engineering, Road development plans, Recent developments – NHAI,NHDP,PMGSY,MSRDC, Highway finance –BOT, Annuity, PPP, DBFO. Highway construction- Types of roads: WBM, BBM, SDBC, DLC& PQC. **UNIT 2**	**6** **10**

Highway Geometric Design: terrain classification, cross-sectional elements highway alignment-definition, requirements, factors controlling alignment, alignment of hill roads., sight distances, horizontal alignment – super elevation, extra widening of pavement on horizontal curve, vertical alignment –gradient, vertical curves, design problems. Highway drainage- necessity, surface draining, sub-surface drainage.Traffic engineering- traffic characteristics, traffic studies. Traffic control devices-road marking, traffic sign, traffic signal, intersection.	**12**

UNIT 3

Pavement materials-

Bituminous materials: types,tests on bitumen, Bituminous mix design: principle, methods and modified binders.Stone aggregates: desirable properties, tests, requirements. **6**

Design of pavements-

Types of pavements, Design steps of flexible highwaypavement as per IRC 37-2001 and **6** problems based on CBR method, Design ofrigid pavement as per IRC 58-2002, Stresses in rigid highway pavements, Joints in rigid pavements: transverse joints, longitudinal joints, fillers andsealers, Pavement design factors, design wheel load, equivalent single wheel load,repetition of loads, equivalent wheel load factors, strength characteristics ofpavement materials, climatic variation.

12

BRIDGE ENGINEERING

UNIT 4

Introduction: Classification of bridges, selection of site, Bridge Hydrology: determination of design discharge, linear water way, economical span, location of piers and abutments, afflux, scour depth, design problems on above topics.

UNIT 5

Standard specification for bridges: - IRC loads, Railway bridge loading, forces acting on super structure. Design considerations, aesthetics of bridge design.Types of bridge foundations, Bridge piers, Abutments, Wing walls, bearings. Construction and maintenance of bridges—Introduction; Recent trends in bridges.

AIRPORT ENGINEERING

UNIT 6

Introduction: Terminology, Airport Classification ICAO, components of an aircraft, aircraft characteristics.Airport Planning: Airport surveys, Site selection, Airport Obstructions, layouts, zoning laws, Environmental considerations. Air Traffic Control: VFR, IFR, Visual aids, airport lighting and marking. Runways: Orientation, wind rose, Basic runway length, Geometric design, Airport capacity, Runway patterns.Taxiways: Layout, geometrical standards, exit taxiways.Terminal Buildings: Site selection, facilities, aprons, parking systems and Heliport.

Text Books	**:**	

1. Highway Engineering Khanna S.K. and C.E.G. Justo NemChand& Bros., Roorkee.

2. 'Transportation Engineering – An Introduction', Prentice Hall of India Ltd., New Delhi.Khistry, C.J.,

Reference Books	:	

1. Pavement Analysis and Design -Yang H. Huang Prentice-Hall.

2. Principles of Transportation Engineering –ParthaChakroborty and Animesh Das - Prentice-Hall India, New Delhi. India

3. Wright, Highway Engineering, 7th Edition WILEY.

4. Highway Engineering- S.K. Sharma.

5. Bridge Engineering- S.P. Bindra.

6. Bridge Engineering -Ponnuswamy S -Tata Mcgraw Hill Publications.

7. Airport Planning and Design -Khanna S.K., Arora M.G. and Jain S.S.- Prentice-Hall India, New Delhi.

8. Airport Engineering, Rao G.V, Tata McGraw Hill

Reference Codes	:	

1. IRC: 76-1979 – Tentative Guidelines for Structural Strength Evaluation of Rigid Airfield Pavement - Indian Roads Congress -IRC, New Delhi.

2. IRC: 85-1983 – Code of Practice for Accelerated Strength Testing and Evaluation of Concrete Road and Air field Constructions- Indian Roads Congress -IRC, New Delhi.

3. IRC: 58-2002 (Second Revision) – Guidelines for the Design of Rigid Pavements for Highways.

4. Indian Roads Congress -IRC, New Delhi.

5. IRC: 37-2001 – Guidelines for the Design of Flexible Pavements for Highways-Indian Roads Congress-IRC, New Delhi.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part I, Sem V**			
Course Title	:	**Lab-ITransportation Engineering –I**	*Course Code*:	:	**CEL 316**
Pre-requisites	:	Geotechnical Engineering.			

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The prerequisite for this course is to possess the knowledge of highway pavement materials, design of pavement and design of airport elements.

Type of Course	**:**	Practical
Course Domain	**:**	core
Skills Imbibed	**:**	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during External Practical Examination

Course Objectives:
1. To familiarize students to procedure about the conducting test on highway material.
2. To learn the objectives of conducting various test on highway material

Course Outcomes:
1. Students will be aware about the procedure adopted for conducting test on highway material.
2. Students will learn the objectives of conducting various tests on highway material.

Practical covered	**:**	

The laboratory work should include the following:

Term work:

I) List of experiments:
      A) Test on Aggregates
1. Specific Gravity and Water Absorption Test.
2. Impact Value.
3. Abrasion Test.
4. Crushing Test.

      B) Test on Bituminous Materials
1. Bitumen Penetration Test.
2. Softening Point.
3. Flash Point and Fire Point Test.
4. Ductility test.
5. Viscosity Test.
6. Stripping value Test.

  II) Assignments on each unit including design problems as follows
1. Design of Flexible Pavement.
2. Design of Rigid pavement.
3. Airport Engineering.

III) Industrial visit with report (Any One)
1. Visit to Hot mix plant.
    2. Visit to Road construction work.

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3. Visit to AirPort.
4. Visit to Bridge.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part I, Sem V**						
Course Title	:	**Geotechnical Engineering-I**				*Course Code*:	:	**CE 313**
Teaching Scheme (Hours)	:	3 hours/weeks = 3 x 13 weeks= 39 hrs minimum				*Total Credits*	:	***04+ 00 +01 =05***
		Tutorial= 01hr/week						
		Practical= 02hr/week						
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50	IPE IOE EPE/EOE	: : :	+50 +50=200	*Duration of SEE*	:	3 hrs
Revision:	:	**Second**				*Month*	:	*December 2017*

Shivaji University, Kolhapur, Maharashtra State, India

Pre-requisites	:	Basic Civil Engineering ,Building Construction material
The prerequisite for this course is to possess the fundamental knowledge of civil engineering and Building Construction material and its properties.		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor
Course Assessment Methods:		
Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.		

Course Objectives:

1. To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures to identify factors controlling soil behavior and methods to determine soil properties. Students will acquire basic knowledge in engineering design of geotechnical systems
2. To make students learn various terminologies related with Geotechnicaland soil engineering.
3.To study the various earth pressure and stress distribution in geotechnical engineering.
4. To understand the stability of slopes and slope stability analysis.

Course Outcomes:

        1. Understand properties of Soil and its classification.

        2. Understand the concepts and analysis of permeability and seepage in soil.

        3. Understand the concept of Compaction and field control of compaction to enhance the strength of soil.

        3. Study the shear strength parameters and method to calculate shear strength of soil.

        4. Evaluate and understand the pressure distribution in soil.

        5. Evaluate earth pressures and apply to check external stability of retaining structures.

Curriculum Content	Hours
UNIT 1 **Properties of Soil** Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils. Three phase soil system, structure of soil, particle size and shape, weight volume relationships, index properties of soil methods of determination and its significance, I.S. classification of soil, field identification of soils. Soil grain and soil aggregate properties of coarse and fine grained soils.	**6**

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UNIT 2 **Permeability and Seepage**	6

Permeability of soil, Capillary water, Darcy's law. Factors affecting permeability. Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I)- pumping in test and pumping out test. Permeability of layered soils. Seepage forces. General flow equation. Flow net and its applications, quick sand condition. Uplift pressure, exit gradient, failure due to piping, criteria for design of filters.

UNIT 3 **Compaction**	**6**

Soil compaction phenomenon. Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line. Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods. Placement water content. Field control of compaction, Compaction of cohesive and non-cohesive soils-relative density.

UNIT 4 **Shear Strength of Soil**	**7**

Stress strain curve, Mohr circle of stress, Mohr-coulomb failure criteria, pore pressure, total and effective stress. Peak and residual shear strength. Factors affecting shear strength. Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test. Shear strength Characteristics of sand and clay. Sensitivity and thixotropy of cohesive soils.

UNIT 5 **Stress Distribution in Soils**	**7**

Boussinesq's theory- point load, line load, strip load, pressure distribution diagram on a horizontal and vertical plane, pressure bulb, Westergaard's theory, contact pressure, approximate stress distribution method.

UNIT 6 **Earth Pressure**	**7**

a) Lateral Earth Pressure
Limit analysis and limit equilibrium methods, effect of wall movement on earth pressure, earth pressure at rest, Rankine's State of plastic equilibrium, submerged backfill, backfill with uniform surcharge, backfill with sloping, Surface, Coulomb's theory.

b) Stability of Slopes
Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesionless soil, slope stability analysis using Swedish Slip Circle Method.
Note- More emphasis would be given on basic fundamentals in the course work.

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Text Books **:**

1. Textbook of Soil Mechanics and Foundation Engineering: Geotechnical Engineering Series Paperback – 2010by V.N.S. Murthy.

2. An Introduction to Soil Mechanics- Arnold Verruijt, Springer International Publishing.

Reference Books **:**

1. Soil Mechanics and Foundations–Dr. B.C.Punmia, Dr. Arun Jain and Dr. Ashok.K. Jain - Laxmi Publication.

2. Textbook Of Soil Mechanics And Foundation Engineering, Murthy C.S.R

3. Karl Terzaghi and Ralph B. Peck, Gholamreza Mesri, Soil Mechanics in EngineeringPractice, Wiley and Sons, 1996.

4. Alamsingh, Soil Mechanics and Foundation Engineering, Vol I & Vol II, Standard bookHouse, 2013.

5. Arora K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors1989, 2nd Edition.

6. Bowles J. E., "Engineering Properties Of Soils And Their Measurements", Tata McGraw-Hill

7. Coduto D. and Donald P., "Geotechnical Engineering Principle and practice", PHI Publisher.

8. Dr. Alam Singh, "Modern Geotechnical Engineering" IBT Publishers, 1992, 3rd Edition.

9. Dr. Kasmalkar B. J., "Geotechnical Engineering" 6. Gulhati S.K. and DattaManoj, "Geotechnical Engineering", Tata McGraw-Hill,2005, 1st Edition.

10. Lambe and Whitman, "Soil Mechanics" (VI Version), Willey Eastern Ltd., New Delhi

11. Peck R.B. and Hanson W.E. T.H. Thornburn, "Foundation Engineering ", John Wiley

12. Purushothma Raj, " Geotechnical Engineering",

13. Ranjan G. and Rao A.S., "Basic and Applied Soil Mechanics",

14. Taylor D.W., "Fundamentals of Soil Engineering", John Wiley and Sons

15. Terzaghi and Peck, "Soil mechanics in Engineering Practice", APH Publisher

16. Venkatramaiah, C., "Geotechnical Engineering" WEL Publishers, 1993, 2nd Edition.

Reference Codes	**:**	

1. IS: 2116 - Permissible clay, silt & fine dust contents in sand.

2. IS:1498 1970- Classification and identification of soils for General Engineering purposes.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part I, Sem-V**			
Course Title	:	**Lab-II Geotechnical Engineering –I**	*Course Code*:	:	**CEL 317**
Pre-requisites	**:**	Basic Civil Engineering.			

The prerequisite for this course is to possess the fundamental knowledge of civil engineering and Building Construction material and its properties.

Type of Course	**:**	Practical
Course Domain	**:**	core
Skills Imbibed	**:**	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during External Practical Examination

Course Objectives:
1. To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures to identify factors controlling soil behavior and methods to determine soil properties. Students will acquire basic knowledge in engineering design of geotechnical systems
2. To learn the objectives of conducting various test on Soil material.

Course Outcomes:
1. Students will be aware about the procedure adopted for conducting test on Soil material.
2.Students will learn the objectives of conducting various tests on Geotechnical engineering   material.

Practical covered	**:**	

  The laboratory work should include the following:

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Term work:

I) List of experiments:

5.   Specific gravity determination by voluminometer / pycnometer / density bottle.
6.   Sieve analysis, particle size determination and I. S. classification.
7. Determination of consistency limits and its use in soil classification.
8.   Field density test by core cutter, sand replacement method.
9. Determination of co-efficient of permeability by constant head and by variable head method.
10. Direct shear test.
11. Standard proctor test.
12. Unconfined Compression Test

II) Industrial visit with report (Any One)
1. Visit to Earthwork site.
   2. Visit to Foundation construction work.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part I, Sem V**				
Course Title	:	**Environmental Engineering-I**		Course Code:	:	**CE 314**
Teaching Scheme (Hours)	:	4 hours/weeks =4 x 13 weeks= 52 hrs minimum		Total Credits	:	***04+00+01= 05***
		Tutorial= 00hr/week				
		Practical= 02hr/week				
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50	IPE : IOE : EPE/EOE : 50	Duration of SEE	:	3 hrs
Revision:	:	**Second**		Month	:	*December 2017*

Pre-requisites	:	Chemistry ,Basic Civil Engineering
The prerequisite for this course is to possess the fundamental knowledge of civil engineering		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

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Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.

Course Objectives:

1. To demonstrated in-depth knowledge within environmental engineering and an awareness of potential social, economic, political, and environmental impacts of engineering practices.
2. An appreciation of the contribution of environmental engineers to the benefit of society and the responsibilities of a professional environmental engineer.
3. To study and design the various treatment processes for water treatment.

Course Outcomes:

1. To get knowledge of air and noise pollution
2. To make the students familiar with sources and its demand of water.
3. To understand the basic characteristics of water and itsdetermination.
4. To expose the students to understand the design of water supply lines.
5. To provide adequate knowledge about the water treatment processes and its design.
6. To have adequate knowledge on operation and maintenance of water supply and leakage Detection and Prevention.

Curriculum Content	Hours
UNIT 1 Air Pollution-Definition, sources of air pollution, types and classification of air pollutants, Primary and Secondary air pollutants and their importance, Atmospheric stability, mixing heights, plume types and meteorological parameters. Effects of air pollution on –Human, Animals, Materials and Vegetation. Global Effects-Photochemical smog, heat island, ozone depletion, acid rain. Control of air pollution. Noise Pollution-Soures, effects and Control.	8 8
UNIT 2 Sources of water, Factors considered in selection of source of water for treatment plant, Conveyance of raw water-, canals and pipelines, Hydraulics of conduits, Different types of pipes used and their suitability, designing of rising main., intake structure, different types of intake structures. Quality-Characteristics, Indian standards, Testing of raw water for physical, chemical and bacteriological parameters and their significance.	9
UNIT 3 Quantity-Population forecasting, different methods of population forecasting, rate of water consumption for various purposes, factors affecting demand of water, calculation of fire demand. Water Treatment: Necessity of water treatment processes. Different types of water treatment flow sheets. Aeration: Principle and Concept, Necessity, Methods, Design of cascade aerator.	9

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UNIT 4 Sedimentation-Theory of sedimentation, types of suspended solids, determination of Settling velocity, Types of sedimentation tanks. Surface Loading, detention time, and design of PST, inlets and outlets arrangements Theory of chemical coagulation, Factors affecting coagulation, turbidity, rapid mixing, coagulant dosage, characteristics of water, optimum pH, Coagulant aids, choice of coagulants, common coagulants, coagulant aids like Bentonite clay, lime stone, silicates and poly electrolytes Rapid mixing -Necessity, gravitational, mechanical, pneumatic devices, Slow mixing and flocculation, design of flocculation chamber, mean vel ocity gradient "G" and power consumption, Concept of Plate settler and Tube settler.	**9** **9**

UNIT 5
Filtration: Theory of filtration, Mechanism of filtration, filter materials, Types of filters-Rapid gravity filter, slow sand-filter and pressure
filter. Components, materials, underdrainage system, working and cleaning of filters, operational troubles, Design of filters.
Theory of disinfection-Factors affecting efficiency of disinfection. Types of disinfectants, Mathematical relationship governing disinfections variables. Theory of chlorination, break point chlorination, bleaching powder estimation.
Water softening methods-
lime-soda, ion exchange method and Demineralization.

UNIT 6
System of water supply-Continuous and intermittent system. Distribution of water-Different distribution systems and their components, layouts, Methods of supply like gravity, pumping and combination, Design of distribution system, determination of Balancing Capacity of ESR , Wastage and leakage of Water-Detection and Prevention, Water audit and Energy Audit
Introduction of hydraulic modeling software's

Reference Books **:**

9. H. V. N. Rao and M. N. Rao,"AirPollution",TMH Publications.

10. S. K. Garg ,"Water Supply Engg.",Khanna Publishers -NewDelhi.

11. Peavy and Rowe, "Environmental Engg.",McGraw Hill Publications

12. Stern,"Air Pollution Vol. I –IV", McGraw Hill.

13. Sharma and Kaur, "Environmental Chemistry", Goyal Publisher.

14. Water Supply and Treatment Manual: Govt. Of India Publication.

15. Steel and McGhee, "Environmental Engineering", McGraw Hill Publications.

16. Duggal K. N., "Water Supply", S. Chand and Company, 2007.

17. Fair G. M, Geyer J. C, and Okun D. A, "Water and Waster Water Engineering Vol. I and II", John Wiley Publication, 1966.

18. Hammer M. J., "Water and Waste Water Technology", Prentice Hall of India Private Limited, 1996.

19. Viessman W. and Hammer M. J, "Water Supply and Pollution Control", Harper Collins College

Publishers, 1993.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part I, Sem-V**

Course Title	:	**Lab-III Environmental Engineering –I**	*Course Code*:	:	**CEL 318**

Pre-requisites	:	Basic Civil Engineering.

The prerequisite for this course is to possess the fundamental knowledge of civil engineering and Building Construction material and its properties.

Type of Course	:	Practical
Course Domain	:	core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during External Practical Examination

Course Objectives:
3. To provide students with basic understanding of physical chemical and biological properties of water samples also the basic knowledge in engineering design of water supply systems.
4. An appreciation of the contribution of environmental engineers to the benefit of society and the responsibilities of a professional environmental engineer.

Course Outcomes:
1. Students will be aware about the procedure adopted for conducting test on water samples.
2.Students will learn the objectives of conducting various tests on Environmental engineering-I.

Practical covered	:	

The laboratory work should include the following:

Term work:

Note-(a ,b&c are compulsory.)
   a) List of experiments:
 (a) Determination of (Any Eight)

     13. pH and Alkalinity
     14. Hardness
     15. Chlorides

16. Chlorine demand and residual chlorine
17. Turbidity and optimum dose of alum
18. Sulphates
19. Fluorides
20. Iron
21. Most Probable Number (MPN)
22. .Ambient air quality monitoring for PM10/PM2.5, SO2& NO$_x$.
23. Measurement of noise levels at various locations using sound level meter, Calculate cumulative noise level at any one location.

B) Site visit to water treatment plant: A report based on the visit to water treatment plant would be submitted and would form a part of the term work.

c) Design of various components of water treatment plant
Design of various components of water treatment plant would be carried out based on the theory covered in
Environmental Engineering-I.

<mark>or</mark>

C) Study of Software or programming for analysis of water distribution
system
Programmes available for the design of various water treatment plants would be used or Computer Programmes to Design various units

Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part I, Sem V**			
Course Title	:	**Construction Management**	Course Code:	:	**CE 315**
Teaching Scheme (Hours)	:	4 hours/weeks = 4 x 13 weeks= 52 hrs minimum	Total Credits	:	*04*

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Evaluation Scheme (Marks)	:	Tutorial= 00hr/week					
		Practical= 00hr/week					
		CIE = (20+20+10) SEE = 50	IPE IOE EPE/EOE	: : :		*Duration of SEE*	:	**3 hrs**
Revision:	:	**Second**				*Month*	:	***December 2017***

Pre-requisites	**:**	Engineering Mathematics, Building Planning.

This course requires the students to know about basic of mathematics,communication skill, market knowledge, basic term used in banking.

Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.

Course Objectives:

1. To familiarize students with basics of engineering management.
2. To understand the management of various resources like Material, Money, and Men required on site.
3.To study the various financial concepts in construction industry.
4. To understand the various on-site aspects like safety, planning etc. in details.

Course Outcomes:

1. Understand concepts and planning engineering management.
2. Understand the concepts and analysis of resource management on site.
3. Understand the financial concepts relating to construction industry.
4. Understand the importance of safety on site.

Curriculum Content	Hours
Construction Management	
UNIT 1 Time Management Introduction, steps in Project Management – work break down structure, Bar Chart, Mile stone chart, Gantt Chart. Activity On Arrow and Activity On Node	**09**
Introduction to PERT: Concept of probability, normal and Beta Distribution, Central limit theorem. Time estimates and calculations of project duration, critical path, slack, probability of project completion. (Problems).	**10**

UNIT 2 CPM : Introduction, Time estimates, floats, critical path. Network compression – Least Cost and optimum duration. Resource allocation-Smoothening and leveling. Updating of networks– needs, steps, project duration, and calculation for updated network.	**10**
	08
UNIT 3 Resource Management Men- Resource allocation – smoothening and leveling. Material Management- definition by international federation of purchasing and material management. Objectives, Role Functions, Qualities of Material Manager, Material forecasting. Inventory Control- Necessity, Techniques such as ABC, EOQ, HML, VED, SDE, etc., lead-time, safety stocks. Assignment and Transportation Problems.	**10**
	05
UNIT 4 Financial Management Objectives, managing working capital, Preparation of cash flow schedule based on funds available and project planning. Law of Diminishing Marginal Utility, Law of Substitution, Introduction to Engineering economics, importance, demand and supply, types of costs, Supply and Demand. Interest – simple, compound, continuous, effective. Value of Money – time and equivalence, tangible and intangible factors, introduction to inflation. Interest factors – Uniform series factors – derivations. **UNIT 5** Economic comparisons Discontinuing methods : Present worth method, equivalent annual cost method, capitalized cost method, net present value, internal rate of return, Benefit Cost Ratio, Payback Period Method. **UNIT 6** Site Layout Factors affecting, Typical layout few major construction projects. Safety Engineering Accident cost, Injury sources and causes, Effective safety programs occupational health hazards, Personal protective equipment, Preparation of safety programs for construction works. Introduction to MIS and its Application in Civil Engineering Industry.	

Reference Books	**:**	

1. Antill and Woodhead, "C.P.M. in Construction Practice",
2. Barrie Paulsion, "Professional Construction Management", McGrew Hill Institution Edition.

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3. Chitkara, "Construction Project Management", Tata MC Graw Hill.
4. Carl Chatfield and Timothy Johnson "Microsoft Project 2016 Step by Step".
5. Gopalkrishnan and Sunderasan, "An Integrated Materials Management".
6. K.S. Menon, "Purchasing And Inventory Control", Wheelar Publication.
7. Layland Blank and Torquin, "Engineering Economics"
8. Naik, "Project Management"
9. Pilcher R., "Principles of Construction Management",
10. Pilcher R., "Project Cost Control in Construction".
11. Punmia B.C., "CPM PERT"
12. Rustogi, "Material management",
13. Senagupta, "Construction Management and Planning", Tata McGraw Hill Publication.
14. Srinath, "CPM PERT"
15. S. Seetharaman, "Construction Management", Umesh Publications S.B. Nath Market, N. Delhi.
16. Taylor G.A., "Management and Engineering Economics"
17. Zamb L.C., "Inventory Control"

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part III, Semester V**						
Course Title	:	**Introduction to Foreign Language**				*Course Code*:	:	**AC 330**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**				*Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**Assignments**	:	**50**	**Written Test** : **25**	*Duration of Exam*	:	**Not Applicable**
		Viva voce	:	**25**	**Grand Total** : **100**			
Revision	:	**Third**				*Month*	:	**June 2018**

Pre-requisites	**:**	As it is the introduction to the language, it has no any pre-requisites

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Type of Course	:	Audit Course at institute level
Course Domain	:	Linguistics
Skills Imbibed	:	Cognitive: Understand, Predicting Situation, Comprehend, Affective : Receive, Listen, Respond, Showing self-reliance, Organize Psychomotor: Imitation, adaptation, articulation, origination

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To make the students able to communicate and translate in foreign languages for the *technical and scientific documentation*, beneficial to Defense and other Government sector services.
2. To make them globally competent in the era of industrial liberalization.
3. To complement their core studies in international business.
4. To make them confident while opting for better career prospects in Multinational Companies (MNCs) for technical and scientific translation/ interpretation tasks while working for joint ventures or collaborative partnership.

Course Outcomes:

1. The students will be able to acquire a good knowledge the basic grammar of foreign language and learn Alphabet, Common Words and Phrases in foreign language.
2. The students will also be able to learn to read the simple texts in foreign language.
3. The students would be able to speak a little using the greetings, well wishes etc. in Foreign Language.
4. The students will learn to count numbers, answer to the questions like, what is your name, surname, tell age, and can initiate little communication in Foreign Language.
5. The students can also translate simple sentences in foreign language.

Curriculum Content	**Hours**
Unit I: General Information on Basic Grammar of the foreign language, Introduction to Alphabet.	05
Unit II: Gender of Noun, Number of Noun, Pronouns, Adjectives, Verbs and their usage in simple sentences, Numbers (up to 10), Simple Greetings in foreign language.	05
Unit III General Questions in foreign language, like What is your name/surname?Who/What is this? Etc.	04
Unit IV: Simple narration about self/family/friend/University in foreign language chosen for studies. Practicing the learnt topics in the class itself.	05
Unit V: Formation of simple sentences using Parts of Speech, Information on Cases, One or Two simple lessons from any book.	05
Unit VI: Basic information on Country & Culture of language under study.	04
Reference Books :	

1. V.N.Wagner and V. G.Ovsienko, Russian, People's Publishing House, New Delhi.
2. S. Khavronina and A. Shirochenskaya, Russian in Exercises.
3. Genki – Japan Times
4. Aural Comprehension in Japanese – Osamu & Nobuko Mizutani.
5. An Introduction to Modern Japanese - Osamu & Nobuko Mizutani.
6. Japanese for Today – Y. Yoshida.
7. Lagune 1(Full set), Published by Langers, (An imprint of Saraswati House Pvt.Ltd), New Delhi 1 10002 (India).

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Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part II, Sem VI**						
Course Title	:	**Theory of Structures-II**				Course Code:	:	**CE 321**
Teaching Scheme (Hours)	:	4 hours/weeks = 4x 13 weeks= 52hrs minimum				Total Credits	:	***04+ 01 +00 =05***
		Tutorial= 01hr/week						
		Practical = ----						
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50	IPE IOE EPE/EOE	: : :	+50 =150		Duration of SEE	:	3 hrs
Revision:	:	Second				Month	:	June 2018

Pre-requisites	:	Engineering Mechanics, Strength of Material, Theory of Structures-I
Basic Knowledge of determinate and indeterminate structures, classical methods of analysis of indeterminate beams, Shear Force Diagram and Bending Moment Diagram, Conjugate Beam Method, Unit Load Method,		

Basics of Matrix Operation		
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive, Affective domain , Psychomotor
Course Assessment Methods: Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.		

Course Objectives:

1. To understand application of classical methods for the analysis of indeterminate structures.

2. To learn the concepts and use of matrix method in structural analysis.

3. To understand the use of ILD for determinate and indeterminate structure.

4. To learn the concepts of moving loads and its effect on structures.

5. To understand structural behavior of three and two hinged arches.

6. To understand approximate methods of analysis for multistoried rigid jointed frames.

Course Outcomes: On completion of the course, the students will be able to:

1. Analyze indeterminate structures using Classical methods.

2. Determine unknown forces of indeterminate structures using Flexibility Method.

3. Compute unknown displacements of indeterminate structures using Stiffness Method.

4. Develop Influence Line Diagram for determinate and indeterminate structures.

5. Demonstrate the behavior of arches and their methods of analysis.

6. Analyzemultistory frames subjected to gravity loads and lateral loads

Curriculum Content	Hours
UNIT 1 Analysis of indeterminate Structures by Displacement Methods A) Slope deflection method	**9**
B) Moment distribution method Applications to Non sway and sway frames	**8**
UNIT 2	**9**

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Flexibility method of analysis: Matrix Formulation, Application to beams, pin-jointed plane trusses, and rectangular plane frames. Settlement of supports	**9**
UNIT 3 Stiffness methods of analysis: Formulation of stiffness matrix. Applications to beams, pin jointed plane trusses and rigid jointed rectangular plane frames, Settlement of supports	**8**
UNIT 4 **Influence lines** Basic Concept of Influence lines, construction of Influence line diagrams for support reactions, SF and BM at a given section of beam. Application of Muller-Breslau's principle, Maximum Influence at a point due to series of concentrated load, Absolute Maximum shear and moment, Influence lines for trusses, influence line diagram for statically indeterminate beams **UNIT 5** Arches – Semi-Circular, Linear, Parabolic arch. Three hinged and two hinged arches, Influence Lines **UNIT 6** Approximate methods of analysis of multistoried, multi bay rigid jointed frames for Gravity and Lateral Load, Substitute Frame Method, Portal method, Cantilever method	**9**

Text Books	:	

1. S.S.Bhavikatti, "Structural Analysis" , Vol.I&Vol.II, New Age Publisher
2. Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill Publication Company Ltd.,
3. T.S.Thandavmoorthy, "Structural Analysis", Oxford Publication

Reference Books	:	

1. Pandit-Gupta, "Structural Analysis A Matrix Approach", Tata McGraw Hill Publication

2. Pandit and Gupta, "Theory of Structures", Tata McGraw Hill Publication

3. Negi and Jangid, "Structural Analysis", Tata McGraw-Hill Publishing Company Ltd., New Delhi,

4. Vazirani and Ratwani, "Analysis of Structures (Vol. I and II)", Khanna Publication, Delhi

5. Leet,Glibert, "Structural Analysis", McGraw Hill Publication

6. Gere and Weaver,"Matrix Analysis of Structures", , CBS Publishers, New Delhi.

7. Junnarkar S.B., "Mechanics of Structures (Vol. II)", Charator Book Publishing House.

8. West H.H. and Geschwindner L.F., "Fundamentals of Structural Analysis", Wiley.

9. Hibbeler R.C., "Structural Analysis", Pearson Education India

10. Norris C.H., Wilbur J.B. and Utku S., "Elementary Structural Analysis", McGraw-Hill

11. Thadani B.N., "Modern Methods in Structural Mechanics - I", Asia Publishing House, New

Delhi,

12. Wang C. K., "Indeterminate Structural Analysis", Tata McGraw-Hill Publishing Company

13. Devdas Menon "Structural Analysis", Narosa Publication

14. Devdas Menon "Advanced Structural Analysis", Narosa Publication

Reference Codes	:	--

Class & Semester	:	**T. Y. B. Tech (Civil Engineering) Part II, Sem VI**			
Course Title	:	**Water Resources Engineering -I**	*Course Code*:	:	**CE 322**
Teaching Scheme (Hours)	:	4 hours/weeks = 4x 13 weeks = 52 hrs minimum	*Total Credits*	:	*04+ 00 +00 =04*
		Tutorial= 00hr/week			
		Practical= 00hr/week			
Evaluation Scheme (Marks)	:	CIE = (20+20+10) IPE : SEE = 50 IOE : Total= 100 EPE/EOE :	*Duration of SEE*	:	**3 hrs**
Revision:	:	**Second**	*Month*	:	*December 2017*

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Pre-requisites	:	Mathematics, Engineering Mechanics, Fluid Mechanics
This course requires the student to know about the basic concepts regarding mathematics, laws of mechanics, fluid statics & dynamics.		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester

End Examination.

Course Objectives:

1. To impart the basic knowledge of importance of Hydrology & irrigation in water resources development.
2. To know various hydro meteorological parameters and their estimation.
3. To create awareness about floods, their estimation using various methods.
4. To understand the importance of irrigation in Indian agricultural industry considering cropping patterns.

Course Outcomes:

1. Apply the knowledge of estimation of hydro meteorological parameters.
2. Design of efficient hydraulic structures.
3. To develop different methods of efficient irrigation and water conservation.
4. To develop the methods of consumptive use of surface water and groundwater.

Curriculum Content	Hours
UNIT 1 **Introduction of Hydrology:** Definition, Importance and scope of hydrology, the hydrologic cycle. **Precipitation:** Forms and types of precipitation, Methods of measurement, Graphical representationof rainfall - Mass rainfall curves, Hyetograph. Determination of average precipitation over thecatchment. **Evaporation:** Process, factors affecting, measurement and control of evaporation. **Infiltration:** Process, Factors affecting and measurement of Infiltration.	**10**
UNIT 2 **Runoff:** Factors affecting runoff, Determination of annual runoff, Rainfall runoff relationship. **Hydrograph:** Storm hydrograph, Base flow and Separation of base flow, direct runoff hydrograph,Unit hydrograph – theory – assumptions and limitations. Derivation and use of unit hydrograph, Scurvehydrograph.	**8**
UNIT 3 **Stream gauging:** Selection of site, discharge measurement by Area velocity method, slope Areamethod. **Floods:** Estimation of peak flow- empirical equations, rational method, Importance ofDesignflood, standard project flood, maximum probable flood, Introduction to flood frequency analysis.	**8**

UNIT 4 **Ground water hydrology:** Occurrence, distribution and classification of ground water, Darcy's law,Aquifer parameters-Permeability, specific yield, specific retention, porosity, storage coefficient,Transmissibility. Hydraulics of well under steady flow conditions in confined and unconfined aquifers, Specificcapacity of well, Recuperation Test, constructional features of Tube wells and Open wells.	**8**
UNIT 5 **Introduction to irrigation**: Definition and necessity of irrigation, ill-effects of irrigation, Surface, Sub-surface, Sprinkler irrigation, Drip Irrigation, Water logging and land drainage. **Water requirement of crops:** Principal crops and crop seasons, cropping pattern and crop rotation, Classes and availability of soilwater, depth and frequency of irrigation,Duty, Delta, Base Period and their relationship, factors affecting duty, methods of improving duty. Assessment and efficiency of irrigation water. Gross Command Area, CulturableCommand Area andcommand area calculations based on crop waterrequirement. Estimation of evapo-transpiration by blaney-criddle method and penman method.	**10**
UNIT 6 **Minor Irrigation Works:** General layout, main components and functioning of – 1. Percolation Tank, 2. K.T.Weir, 3. Bandhara irrigation 4. Lift irrigation **Watershed Management:** Need and importance of watershed management, Soil conservationmeasures, Techniques of Rainwater and groundwater harvesting.	**8**

Text Books	**:**	
1. Irrigation Engineering – S. K. Garg – Khanna Publishers, Delhi. 2. Irrigation, Water Resources and Water Power Engineering – Dr P.N. Modi 3. Irrigation and Water Power Engineering – Dr Punmia and Dr.Pande – Laxmi Publications,Delhi 4. 'Engineering Hydrology' – Dr. K. Subramanya., -Tata McGraw Hill, New Delhi. 5. Hydrology – Dr. P Jayarami Reddy, Laxmi Publications, New Delhi 6. 'Engineering Hydrology' – Dr. Raghunath H.M. - New Age International Publishers. 7. Watershed Management in India – J.V.S.Murthy – Wiley Eastern Publications, Delhi. 8. Irrigation Engineering – Dahigaonkar Asian Book Pvt Ltd 9. Irrigation Engineering, Raghunath, WILEY,		

Reference Books	**:**	
1. R.K.Sharma, 'Hydrology and water resources', Dhanpatrai and sons, New Delhi. 2. Varshney, Gupta and Gupta, 'Theory and design of irrigation structures vol. I and II and III,Newchand and Brothers. 3. Michael, 'Irrigation Theory and practice', Vikas Publications House. 4. Jaspal Sing, M.S.Acharya, Arun Sharma, 'Water management', Himanshu Publications. 5. Design of M.I. and Canal Structure – Satyanarayan and R. Murthy. 6. Water and Soil Conservation – Ghanshyam Das.		

Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part II, Sem VI**			
Course Title	:	**Transportation Engineering-II**	*Course Code*:	:	**CE 323**
Teaching Scheme (Hours)	:	4 hours/weeks = 4x 13 weeks= 52 hrs minimum	*Total Credits*	:	*04+ 00 +00 =04*
		Tutorial= 00hr/week			
		Practical= 00hr/week			

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Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50 Total= 100	IPE IOE EPE/EOE	: : :		*Duration of SEE*	:	**3 hrs**
Revision:	:	**Second**				*Month*	:	***December 2017***

Pre-requisites	:	Geotechnical Engineering.
This course requires the student to know about the basic of civil engineering, fundamentals of geotechnical engineering, water resources engineering and structural engineering etc.		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester

End Examination.

Course Objectives:

1. To familiarize students with sub-branches of Transportation Engineering such as railway engineering, tunnel engineering, dock and harbour engineering.

2. To make students learn various terminologies related with railway engineering, tunnel engineering, dock and harbour engineering.

3. To study the various components involved in railway engineering, tunnel engineering, dock and harbour engineering.

4. To understand the planning aspect involved in railway engineering, tunnel engineering, dock and harbour engineering.

Course Outcomes:

1. Apply basics of railway engineering, its components and geometric design.
2. Signalling and interlocking in railway engineering, construction and maintenance of
railway track and modern trends in railways.
3. To Understand principles and basics of tunnel engineering.
4. To Understand principles and basics of dock and harbor engineering.

Curriculum Content	**Hours**

RAILWAY ENGINEERING	
UNIT 1	
a) Introduction, History , Organizational structure of Indian railways,railway lines classification based on speeds , Modernization in Railways and railway tracks, High speed rail tracks, metro rail, bullet train, hyper loop train concept.	**12**
b) Permanent Way: Types of rail sections, Components, coning of wheels. Rail creep, Rail defects, Rail joints, welding of rails, short welded rail (SWR), long welded rail (LWR) and continuously welded rail (CWR), sleepers requirement, Sleeper density, spacing, and types, Rail fittings, Elastic fastenings, bearing plates, anti-creep devices, check and guard rails, Ballast requirements and specification, Formation, Different cross sections of Track in cutting and embankment, suitability of drainage.	
	14
UNIT 2	
a) Geometric design: Alignment, gradient, horizontal curves, Grade Compensation on curves super elevation, design problems on above. Speed on curves, safe speed on curves using Indian railway formula only for fully transitioned curves. Gauge widening. Points, crossing and turnouts	
b) Points & Crossing: Terms used, standard points and crossings, design of simple turnout various types of track junctions.	
c) Stations and yards: purpose, location, site selection, types andgeneral layouts of terminus, Junction.	**8**
d) Signalling and interlocking—Introduction, Construction andmaintenance of railway track: methods, material required per KM oftrack, tools and plant used for plate laying, maintenance of Track,Modern trends in railways. Visit to railway station.	
TUNNELING	**8**
UNIT 3	
a) Introduction, Advantages and disadvantages of tunnel with respect to open cuts,Tunnel surveying, Surface surveys, Transferring centerline, Setting out and Transfer of Levels. Underground. Criteria for Selection of size and shape of tunnels, Factors affecting the methods of Tunneling.Geological investigation for tunnels and its importance, tunnel alignment, tunnel shafts, pilot tunnels.	
	5
b) Tunneling in hard rock, (TBM).	
c) Tunneling in soft materials: shield methods. Tunnel lining (rock bolting and guniting), Safety measures, ventilation, lighting and drainage of tunnels.	
UNIT 4	**5**

Driving tunnels in hard ground Sequence of operation and typical distribution of time for each operations, Meaning of the term 'Faces of Attack', Drill blast method of tunneling for hard strata, Different patterns of drilling. Blasting and explosives
Meaning of the terms, types of explosives, method of blasting in brief.
Ventilation Meaning of the term, requirements a ventilating system, Methods of ventilation with advantages and disadvantages. Lighting and aspects of drainage in brief. Method of supporting roof consisting of shot creating. Cement grouting, rock bolting, Cast in-situ and precast lining.

DOCK AND HARBOUR ENGINEERING

UNIT 5

a) Introduction,Definition, Requirements, classification of harbors with examples, Factors affecting growth of port, Major Ports in India and abroad, Planning a Port, Selection of ideal location of harbor, Introduction to dredging.
Inland water transport in India, tides, waves, erosion, beach drift, littoral drift sand bars, coast protection, classification of ports and harbors, sites selection, break waters, jetties, wharves, piers, facilities required.

b) Types of dock, navigational aids, lighthouses, terminal buildings special equipments, Containerization.

UNIT 6

Breakwater and materials of construction for breakwater, Introduction to design of break waters, Dock, Bulkhead and Sea Walls, Design Considerations and Construction Materials, Revetments, Water front structures, Wharves, Jetty, Dolphins, Different types of dock fenders, Uses of wet docks and Dry/ Repair docks. Port facilities, Transit sheds and warehouses. Visit to dock, harbor or port.

Text Books	:	

1. Principals of Railway Engineering - Saxena and Bindra, Dhanpat Rai& Sons
2. Tunnel, Bridge and Railway Engineering- Saxena and Bindra - Dhanpat Rai & Sons
3.Dock and Harbor Engineering OzaChartor pub. House

Reference Books	:	

1. Rangwala S. C., "Principles of Railway Engineering", CBS Publishers, 1965, 2nd Edition.
2. Saxena S.C., Arora, "A Textbook of Railway Engineering", Dhanpat Rai and Sons, Delhi.
3. Mundrey J.S., "Railways Track Engineering', Tata Mcgraw Hill, New Delhi.
4. SaxenaSubhash C., "Tunnel Engineering", Dhanpat Rai and Sons, New Delhi.
5. Vazirani V.N. and Chandola S.P., "Transportation Engineering Volume 1".
6. Mathur G. N. and Chawla A. B., "Productivity and Speed Tunneling", CBIP, 2003.
7. Megaw T. M. and Bartlett J., "Tunnels Planning, Design, Construction", EHJW, 1983, 8. Murthy G. V., "Tunnels and Elements of Docks and Harbours".
9. Saxena S. C., "Tunnel Engineering", Dhanpat Rai and Sons, 1984, 1st Edition.
10. Bindra S. P., "Dock and Harbour Engineering", Dhanpat Rai Publications, 1979, 1st Edition.
11. Coaster Engineering Manuals Volume I and II, US Army Corps of Engineers, Vicksburg.
12. Quinn, "Planning and construction of Docks and Harbours", Tata McGraw Hill.
13. Dock, Harbor and Tunnel Engineering-Shrinivasan- Chartor pub. House.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part II, Sem VI**				
Course Title	:	**Environmental Engineering-II**		*Course Code*:	:	**CE 324**
Teaching Scheme (Hours)	:	3 hours/weeks = 4x 13 weeks= 52 hrs minimum		*Total Credits*	:	***04+ 01 +00 =05***
		Tutorial= 00hr/week				
		Practical= 2hr/week				
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50 Total= 100	IPE : IOE : EPE/EOE : 50	*Duration of SEE*	:	3 hrs
Revision:	:	**Second**		*Month*	:	*December 2017*

Pre-requisites	:	Chemistry, Basic Civil Engineering Knowledge
This course requires the student to know about the method of analysis, Titration Basics of civil Engineering,		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.

Course Objectives:

4. To describe wastewater , its sources, characteristics and collection system
5. To design the various treatment processes for wastewater treatment.

6. To study different operational problems and their remedies .
7. To explain various aspects of solid waste management.
8. To outline the effects of air pollution and its control measures.

Course Outcomes:

At the end of this course students will be able to learn to
1 Explain sources, characteristics and collection system of wastewater.
2 Design the various treatment processes for wastewater treatment.
3 Apply the knowledge to solve different operational problems and their remedies
4 Understand importance of   solid waste management.
5 Describe the effects of air pollution and its control measures.

Curriculum Content	Hours
UNIT 1	
Introduction	8
Objective, Basic design considerations like Engineering , Environmental Process, flow diagrams, Design Period.	
Characteristics of wastewater	
Physical, Chemical and Biological characteristics, Wastewater sampling and analysis, and practical Significance of test results.	
River Sanitation	
Self-purification of natural streams, Stream standards, effluents Standards, Oxygen Sag Curve.	9
UNIT 2	
Sewerage Flow	
Sources of sewage, Variations in sewage flow, storm-water runoff, ground water infiltration.	
Design of sanitary sewers, Minimum size of sewer, velocities in sewers and gradient of sewers.	
Sewer appurtenances i.e. manholes, street inlets, flushing devices, Vent pipes etc. Pumping of sewage, types of pumps for sewage pumping.	
	9
UNIT 3	
Wastewater Treatment	
Theory and design of primary treatment UNITs.	
Screens: Types of screens, design of screen chamber, disposal of Screenings.	
Grit Chamber: Sources of grit, velocity control in grit chamber, design of grit chambers	9
including proportionalflow weir, disposal of grit,	
Sources of oil and grease, importance of removal, methods of oil and grease removal, design of skimming tanks.	
	9

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Primary Sedimentation: Necessity, design of PST with inlet and outlet details, Primary Sludge and its disposal.

UNIT 4

Theory and Design of Aerobic Secondary Treatment UNITs

Activated sludge Process: Biological principle, modification of ASP, sludge volume index, sludge bulking and control.

Trickling filter: Biological principle, different T.F. And their characteristics, Deign of standard rate or High ratefilters, single stage and two stage filters, Re circulation, Ventilation, Operational problems, Control measure, Rotating Biological Contactor.

Theory and Design of Anaerobic Treatment Units

Septic tanks, suitable conditions and situations, biological Principle, method of treatment and disposal of septic Tank effluent.

UNIT 5

Solid Waste Management :

Definition, types,sources,characteristics. Functional outline, Generation, storage, collection, Processing techniques.
Methods of treatment, Composting, Incineration, Pyrolysis, Sanitary land filling, Concept of Hazardous waste management.

UNIT 6

Emerging Technologies for Waste Water Treatment

Centralized sewage treatment systems, Consequences of centralized wastewater treatment, Objectives of small
and decentralized wastewater treatment systems
Advantages of Decentralized Wastewater Treatment, Applications of decentralized wastewater management to:
a) Root zone Technology Principle, types of plants used, advantages, disadvantages
b) Constructed wastelands process description, advantages and disadvantages
c) Duckweed ponds process description, advantages and disadvantages
d) Fluidized aerobic bed technology Principle, process description, advantages Disadvantages
e) Up flow sludge Blanket Reactors (UASBR) - Principle, design, advantages and disadvantages

8

Reference Books	:	

1. Bhide, A.D., and Sunderasen B.B., "Solid Waste Management in Developing

   Countries", Indian National Scientific Documentation Centre, New Delhi, 1998.

2. Canter, "Environmental Impact Assessment", TMH Publication, 2000.

3. Hammer and Hammer, "Water and Wastewater Technology", Prentice Hall Publication, 2008

4. Garg S. K, "Sewage Disposal and Air Pollution Engineering", Khanna Publishers, 2000.

5. Garg S.K., "Wastewater Engineering", Khanna publication, 2000

6. Gray N. F., "Water Technology", Butterworth-Heinamann, 2002

7. Masters G. M., "Introduction to Environmental Engineering and Science", 2004.

8. Metcalf and Eddy, "Waste Water Engineering Treatment and Disposal", Tata Mc-Graw-Hill Publication, 2003.

9. Peavy H. S., Rowe D. R., and Tchobanoglous, "Environmental Engineering", McGraw-Hill Book Company, 1985.

10. Rao M.N. and Rao H.V.N., "Air Pollution", Tata McGraw Hill, 2006.

11. Rao P. V., "Environmental Engineering – II", Tata McGraw Hill Publication, 2003

12. Soli J. Arceivala, "Wastewater Treatment For Pollution Control", 1999

13. Viessman W. and Hammer M. J, "Water Supply and Pollution Control", Harper Collins College Publishers, 1993.

14. Manual on sewerage and sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97, Ministry of Urban development

15. "Manual on Municipal Solid Waste and Management", Government of India Publication, 2000.

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Class & Semester	:	**T. Y. B.Tech (Civil Engineering) Part II, Sem VI**						
Course Title	:	**Geotechnical Engineering-II**				*Course Code*:	:	**CE325**
Teaching Scheme (Hours)	:	3 hours/weeks = 3 x 13 weeks= 39 hrs minimum				*Total Credits*	:	***04+ 00 +01 =05***
		Tutorial= 00hr/week						
		Practical= 02hr/week						
Evaluation Scheme (Marks)	:	CIE = (20+20+10) SEE = 50	IPE IOE EPE/EOE	: : :	+50 +50=200	*Duration of SEE*	:	3 hrs
Revision:	:	**Second**				*Month*	:	*December 2017*

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Pre-requisites	:	Soil Mechanics and Geotechnical engineering –I.
The prerequisite for this course is to possess the fundamental knowledge of Soil engineering and Geotechnical engineering-I.		
Type of Course	:	Theory
Course Domain	:	Core
Skills Imbibed	:	Cognitive, Affective domain , Psychomotor
Course Assessment Methods:		
Student is evaluated during Continuous Internal Evaluation (Internal Test I & Internal Test II) and Semester End Examination.		

Course Objectives:

1. To provide a coherent development to the students for the courses in sector of Geotechnical Engineering & Soil Improvement Techniques etc.
2. To involve the application of scientific and technical principles of planning, analysis, design of foundation along with soil improvement techniques.
3. To study the bearing capacity of soil and settlement calculation in geotechnical engineering.
4. To present the foundations of many basic Engineering tools and concepts related Geotechnical Engineering.

Course Outcomes:

1. Understand various field test for bearing capacity of soil and to investigate the soil.
2. Determine the pre consolidation pressure and consolidation in soil.
3. Understand the concept of bearing capacity and its analysis by using various equations.
4. Evaluate and understand the consolidation settlement and settlement in soil.
5. Design the various types of foundation and its calculations.

Curriculum Content	Hours
UNIT 1 **Introduction** Functions of substructure, Common Types of foundations viz. shallow and deep foundations, isolated and combined footings, raft, pile, well foundations, suitability and applications. Minimum depth of footing, effect of surcharge load on foundations, allowable soil pressure, and serviceability requirements.	**6**
UNIT 2 **Soil Exploration** Purpose, importance, methods of soil exploration, subsurface exploration, trial pits, boring: method of borings. Number of boreholes, depth and spacing of boreholes, types of test to suit the soil conditions, Location of water table, Sampling: Disturbed And Undisturbed Samples, Field tests: SPT, DCPT, SCPT, pressure-meter test, plate load test, field vane shear test.	**7**

UNIT 3 **Consolidation** Spring analogy, Terzaghi's theory of one dimensional consolidation, Lab consolidation test, determination of consolidation parameters viz. cc cv , mv and av. Square root and logarithm of time fitting method. Rate of settlement, normally and over consolidated soils, Determination of pre consolidation pressure, Evaluation of consolidation settlement.	**6**

UNIT 4
Shallow Foundation
  a) **Bearing Capacity**
 	
Terzaghi's bearing capacity analysis, Meyerhof, Hansen's and basic equations for strip, rectangular and round footing, effect of various BC factor on bearing capacity, Use of field test (SPT and Plate Load) data for bearing capacity determination, bearing capacity of rocks, RQD concept.
 	
  b) **Settlement**
 	
Total and differential settlement, Tolerable settlement, IS Criteria, Concept of pressure bulb.
Slope Stability: Stability of finite slopes- slip circle method, Semi graphical and graphical methods, location of critical slip circle center, Friction circle method, , Stability number concept and its use.
 	
  c) **Design of Shallow Foundation**
 	
Concept of isolated and floating foundation, Raft foundation.
	7

UNIT 5 **Pile Foundation** Pile classification, Carrying capacity of pile, static and dynamic methods, pile load test, group action, Rigid block method, Negative skin friction, Settlement of single and group of piles. **UNIT 6** **Well Foundation and Caissons** Element of wells, types, methods of construction, tilt and shift, remedial measures, **Pneumatic caissons**: Caisson disease. **Sheet Piles:** Classification, Design of cantilever sheet pile in cohesionless and cohesive soils. Design of anchored sheet pile by free earth support method. Cellular Cofferdams: Types, cell fill stability considerations.	**7**
UNIT 6 **Well Foundation and Caissons** Element of wells, types, methods of construction, tilt and shift, remedial measures, Pneumatic caissons: Caisson disease. Sheet Piles: Classification, Design of cantilever sheet pile in cohesionless and cohesive soils. Design of anchored sheet pile by free earth support method. Cellular Cofferdams: Types, cell fill stability considerations.	**6**

Text Books	:	

3. Textbook of Soil Mechanics and Foundation Engineering: Geotechnical Engineering Series Paperback – 2010by V.N.S. Murthy.

4. An Introduction to Soil Mechanics- Arnold Verruijt, Springer International Publishing.

Reference Books	:	

5. Soil Mechanics and Foundations–Dr. B.C.Punmia, Dr. Arun Jain and Dr. Ashok.K. Jain - Laxmi Publication.

6. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors

7. Bowles J. E., "Foundation Analysis and Design", McGraw-Hill International.

8. Dass B. M., "Foundation Engineering",

9. Dr. Kasmalkar B. J., "Foundation Engineering"

10. Nayak N. V., "Foundation Design Manual".

11. Ranjan Gopal and Rao A. S., "Basic and Applied Soil Mechanics",

12. Dr. Alam Singh, "Modern Geotechnical Engineering" IBT Publishers, 1992, 3rd Edition.

13. Dr. Kasmalkar B. J., "Geotechnical Engineering" 6. Gulhati S.K. and DattaManoj, "Geotechnical Engineering", Tata McGraw-Hill,2005, 1st Edition.

14. Peck R.B. and Hanson W.E. T.H. Thornburn, "Foundation Engineering ", John Wiley

Reference Codes	:	

15. IS: 2116 - Permissible clay, silt & fine dust contents in sand.

16. IS:1498 1970- Classification and identification of soils for General Engineering purposes.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part II, Sem-VI**

Course Title	:	**Lab-II Geotechnical Engineering –II**		*Course Code*:	:	**CEL 326**
Pre-requisites		:	Geotechnical Engineering -I			

The prerequisite for this course is to possess the fundamental knowledge of Soil engineering and Geotechnical engineering-I.

Type of Course		:	Practical
Course Domain		:	core
Skills Imbibed		:	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during External Practical Examination

Course Objectives:
5. To involve the application of scientific and technical principles of planning, analysis, design of foundation along with soil improvement techniques.
6. To provide a coherent development to the students for the courses in sector of Geotechnical Engineering & Soil Improvement Techniques etc.

Course Outcomes:
1. Students will be aware about the procedure adopted for conducting test on Soil material.
2. To study the bearing capacity of soil and settlement calculation in geotechnical engineering.

Practical covered	:	

The laboratory work should include the following:

Term work:

I)   List of experiments:
1. Determine the bearing capacity of soil by using plate load test.
2. Determination of standard penetration Test.
3. Determination of consolidation Settlement of soil.
4. Demonstration on soil sampling.

II)   A) Design Problem-
1. Bearing capacity calculation by various method and settlement calculations
2. Design of shallow foundation
3. Pile and Pile group
4. Cantilever sheet pile
5. Stability analysis

III) Industrial visit with report (Any One)
1. Visit to Earthwork site.

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2. Visit to Foundation construction Site and preparation of report.			

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part II, Sem VI**					

Course Title	:	**Lab-III Structural Design and Drawing - I**	*Course Code*:	:	**CEL 328**
Teaching Scheme (Hours)	:	2 hr /week=2x13= 26 hrs	*Credits*	:	**1**
Evaluation Scheme (Marks)	:	IPE : + EPE : 50 = 50 IOE : EOE :	*Duration of Exam (in case of External Evaluation)*	:	
Revision:	:	Second	*Month*	:	*December 2017*

Pre-requisites	**:**	

The prerequisite for this course is to possess the knowledge of design of various components of steel structure by Limit State Method of Design.

Type of Course	**:**	Practical
Course Domain	**:**	core
Skills Imbibed	**:**	Cognitive, Affective domain , Psychomotor

Course Assessment Methods:

Student is evaluated during External Practical Examination

Course Objectives:
1. To understand the use of IS Codes related to structural design of steel structures
2. To calculate loads on steel structure
3. To analyze the steel structure
4. To design steel structure
5. To prepare detailed structural drawings of a steel structure

Course Outcomes:
1. Understand the use of IS Codes related to structural design of steel structures
2. Calculate loads on steel structure
3. Analyze the steel structure
4. Design steel structure
5. Prepare detailed structural drawings of a steel structure

Practical covered	**:**	

The laboratory work should include the following:

1. Design of any **ONE** structure as per IS 800- 2007

   a) Industrial building with roof supported by steel trusses.

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    b) Pedestrian bridge

    c) Design of Pre Engineered Building

2.   Design of any **ONE** structure

    a) Design of continuous beams using plastic analysis as per SP:6

    b) Design of plate girder (welded)

3.   The Report should include :Brief Technical design project report involving Introduction, assumptions, load calculations, analysis, preferably using suitable software (such as STADD.PRO, STRUD, ETABS, SAP, etc.) and detailed design.

4.   Drawings

    Structural plan and detailed structural drawings (AUTOCAD may be used)

5.   Report of a site visit mentioning structural details with relevant sketches of structural connections.

Class & Semester	:	**T. Y. B.Tech (Civil Engineering), Part III, Semester VI**								
Course Title	:	**Research Methodology**					*Course Code*:		:	**RM 331**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**					*Credits*		:	**Nil**
Evaluation Scheme (Marks)	:	**Assignments**	:	**50**	**Written Test**	:	**25**	*Duration of Exam*	:	**Not Applicable**
		Viva voce	:	**25**	**Grand Total**	:	**100**			
Revision	:	**Third**					*Month*		:	**June 2018**

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Pre-requisites	:	H.S.C level English Language Competency
Type of Course	:	Audit Course at institute level
Course Domain	:	Research Skills
Skills Imbibed	:	Cognitive: Understand, Predicting Situation, Comprehend, Affective : Receive, Listen, Respond, Showing self-reliance, Organize Psychomotor: Imitation, adaptation, articulation, origination

Course Assessment Methods:

     The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:
1. To gain familiarity with research phenomenon or to achieve new insights into it (known as exploratory or formulative research studies) ;
2. To develop an understanding of various research designs and techniques;
3. To identify various sources of information for literature review and data collection;
4. To judge the frequency with which something occurs or with which it is associated with something else (known as diagnostic research studies);
5. To know about testing a hypothesis of a causal relationship between variables (known as hypothesis-testing research studies) ;

Course Outcomes: At the end of the course, the students
1. Will be able to understand some basic concepts of research and its methodologies;
2. Will be able to identify appropriate research topics ;
3. Will be able to select and define appropriate research problem and parameters;
4. Will be able to prepare a project proposal (to undertake a project) ;
5. Will be able to organize and conduct research (advanced project) in a more appropriate manner write a research report;

Curriculum Content	Hours
Unit I: Introduction to Research: Definition and basic Types of research, Research process and steps in it, Concept of Hypothesis, Research proposals and aspects.	03
Unit II: Basic Statistics required for any research Introduction to Descriptive Statistics, Statistical data, Variable, Classification of data, exploratory data analysis, Measures of central tendency, Dispersion-Standard deviation,	06

Correlation and regression analysis.	
Unit III: Introduction to Design of Experiment: Concept of design of experiment, its objectives, strategies, Factorial experimental design, designing engineering experiments, basic principles, of replication. Guidelines of experiments.	06
Unit IV : Single Factor Experiment: Hypothesis testing, Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, goodness of fit tests, Chi-Square test, Kolmogorov-Smirnov(K-S) test.	07
Unit V: Two factor Factorial Design: Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two□factor factorial design; Models□Effects, means and regression, Hypothesis testing.	07
Reference Books **:**	
1. Kothari, C.R., Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009. 2. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, Wiley India. 3. Montgomery, Douglas C. &Runger, George C. (2007), 3/e, Applied Statistics & Probability for Engineers, Wiley India. 4. J.Medhi, Statistics Methods, New Age Publications, New Delhi 2009. 5. Nabendu Pal and Saheb Sarkar, Statistics: Concepts and Applications, Prentice Hall of India Pvt.Ltd. New Delhi, 2004. 6. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.	

Equivalence of Third Year B.Tech (Civil Engineering)
Semester V and VI

The above detailed syllabus is a revised version of the Third Year. B.Tech (Civil Engineering) course being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from Academic year 2018-2019). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects of Civil Engineering at Third Year B Tech Semester V and VI pre-revised course under the faculty of Engineering and Technology is as follows.

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Department of Technology (Civil Engineering) Program – Syllabus w.e.f. 2018-2019

Third Year B.Tech Semester V (Civil Engineering)

Sr.No	Third Year B.Tech Semester V (Civil Engineering) Pre-revised syllabus	Third Year B.Tech Semester V (Civil Engineering) Revised syllabus	Remark
1.	Design of steel Structures	Design of steel Structures	No change
2.	Transportation Engineering –I	Transportation Engineering –I	No change
3.	Geotechnical Engineering- I	Geotechnical Engineering- I	No change
4.	Environmental Engineering-I	Environmental Engineering-I	No change
5.	Construction Management	Construction Management	No change
6.	Lab-I Transportation Engineering –I	Lab-I Transportation Engineering –I	No change
7.	Lab-II Geotechnical Engineering- I	Lab-II Geotechnical Engineering- I	No change
8.	Lab-III Environmental Engineering-I	Lab-III Environmental Engineering-I	No change
9.	Seminar	Seminar	No change
10.	Internship-I	Internship-I	No change
11.	Presentation and Communication Techniques	Presentation and Communication Techniques	No change

Third Year B.Tech Semester VI (Civil Engineering)

Sr.No	Third Year B.Tech Semester VI (Civil Engineering) Pre-revised syllabus	Third Year B.Tech Semester VI (Civil Engineering) Revised syllabus	Remark
1.	Theory of structures -II	Theory of structures -II	Change in Number of Lecture
2.	Water Resource Engineering -I	Water Resource Engineering -I	No change

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Department of Technology (Civil Engineering) Program – Syllabus w.e.f. 2018-2019

3.	Transportation Engineering –II	Transportation Engineering –II	No change
4.	Environmental Engineering-II	Environmental Engineering-II	No change
5.	Geotechnical Engineering- II	Geotechnical Engineering- II	No change
6.	Lab-I Geotechnical Engineering-II	Lab-I Geotechnical Engineering-II	No change
7.	Lab-II Environmental Engineering-II	Lab-II Environmental Engineering-II	No change
8.	Lab-III Structural Design Drawing-I	Lab-III Structural Design Drawing-I	IOE for 50 Marks added
9.	Mini Project	Mini Project	No change
10.	Internship- II	-------	Shifted to Semester VII
11.	Research Methodology		No change

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