

**Savitribai Phule University of Pune**  
**Third Year Civil Engineering**  
**(2015 Course)**

**Semester I**

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301001	Hydrology and water resource engineering.	03	--	02	30	70	--	50	--	<b>150</b>	04	01
301002	Infrastructure Engineering and Construction Techniques	03	--	--	30	70	--	--	--	<b>100</b>	04	--
301003	Structural Design-I	04	--	04	30	70	50	50	--	<b>200</b>	04	02
301004	Structural Analysis-II	04	--	--	30	70	--	--	--	<b>100</b>	04	--
301005	Fluid Mechanics-II	04	--	02	30	70	--	50	--	<b>150</b>	04	01
301006	Employability Skills development	--	--	02	--	--	50	--	--	<b>50</b>	--	01
Total		18	--	10	<b>150</b>	<b>350</b>	<b>100</b>	<b>150</b>		<b>750</b>	<b>20</b>	<b>05</b>

### Semester II

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301007	Advanced Surveying	03	--	02	30	70	50	--	--	<b>150</b>	04	01
301008	Project Management and Engineering Economics	04	--	--	30	70	--	--	--	<b>100</b>	04	--
301009	Foundation Engineering	03	--	--	30	70	--	--	--	<b>100</b>	04	--
301010	Structural Design-II	04	--	04	30	70	50	50	--	<b>200</b>	04	02
301011	Environmental Engineering-I	04	--	02	30	70	--	--	50	<b>150</b>	04	01
301012	Seminar	--	--	01	--	--	--	50	--	<b>50</b>	--	01
Total		18	--	09	<b>150</b>	<b>350</b>	<b>100</b>	<b>100</b>	<b>50</b>	<b>750</b>	<b>20</b>	<b>05</b>

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301001 Hydrology and Water Resource Engineering**

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

**Unit – I** **(06 hours)**

**Introduction to Hydrology:**

Hydrological cycle, Application of hydrology

**Precipitation:**

Types of precipitation, measurement, Rain gauge network, Preparation of data-estimation of missing data, Consistency test, Presentation of rainfall data-mass rainfall curves, Hyetograph, Point rainfall, Moving average, Mean precipitation over an area- arithmetic mean method, Thiessen's polygon, isohyetal method, Concepts of depth-area-duration analysis, Frequency analysis - frequency of point rainfall and plotting position, Intensity-duration curves, Maximum Intensity-duration- frequency analysis

**Abstractions of Precipitation:** Intersection, Depression storage, Evaporation- Elementary concepts, factors affecting, Measurement of evaporation, Transpiration, Evapotranspiration- process and measurement, Infiltration –introduction, Infiltration capacity, Infiltrometer, Horton's method and infiltration indices

**Stream Gauging:**

Selection of site, various methods of discharge measurement (velocity-area method, dilution method, slope-area method), Advance techniques/equipments used in gauge discharge measurements such as Radar, Current meter, ADCP (Acoustic Doppler Current Profiler)

**Unit – II** **(06 hours)**

**Introduction to Irrigation:**

Definition, Functions, Advantages and Necessity, Methods of Irrigation, Surface Irrigation, Subsurface Irrigation, Micro-Irrigation

**Water Requirements of Crops:**

Soil moisture and Crop water relationship, Factors governing Consumptive use of water, Principal Indian crops, their season and water requirement, Crop planning, Agricultural practices, Calculations of canal and reservoir capacities – duty, delta, irrigation efficiency

**Assessment of Canal Revenue:**

Various methods (Area basis or crop rate basis, volumetric basis, seasonal basis, composite rate basis, permanent basis or betterment levy basis)

**Unit III** **(06 hours)**

### **Ground Water Hydrology:**

Occurrences and distribution of ground water, Specific yield of aquifers, Movement of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well, Well Irrigation: Tube wells, Open wells and their construction

### **Unit – IV**

**(06 hours)**

#### **Runoff:**

Introduction, Factors affecting runoff, Rainfall-Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph- Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall, Unit hydrograph theory, S-curve hydrograph, uses and limitations of Unit Hydrograph

#### **Floods:**

Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods

### **Unit – V**

**(06 hours)**

**Reservoir Planning:** Introduction, Term related to reservoir planning (Yield, Reservoir planning and operation curves, Reservoir storage, Reservoir clearance), Investigation for reservoir planning, Significance of mass curve and demand curves, Applications of mass curve and demand curves, Fixation of reservoir capacity from annual inflow and outflow, Fixation of reservoir capacity using elevation capacity curve and dependable yield, Reservoir regulation, Flood routing- Graphical or I.S.D method, Trial and error method, Reservoir losses, Reservoir sedimentation- Phenomenon, Measures to control reservoir sedimentation, Density currents Significance of trap efficiency, Useful life of reservoir, Costs of reservoir, Apportionment of total cost, Use of facilities method, Equal apportionment method, Alternative justifiable expenditure method

### **Unit VI**

**(06 hours)**

#### **Water Management:**

Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Cooperative water distribution systems, Introduction to auto weather station

#### **Water Logging and Drainage:**

The process of water logging, Causes of water logging, Effects of water logging, preventive and curative measures, Land drainage, Reclamation of water logged areas, Alkaline and saline lands.

#### **Reference Books**

1. Irrigation Engineering - S. K. Garg, Khanna Publishers
2. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House.
3. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Standard Publisher
4. Elementary Engineering Hydrology- M.J.Deodhar-Pearson Education

5. Engineering Hydrology. –Ojha—Oxford University Press
6. Engineering hydrology – K. Subramanyam Tata McGraw Hill.
7. Hydrology- Principles, Analysis and Design, Raghunath, New Age International
8. Irrigation Engineering-Raghunath--Wiley
9. Groundwater Hydrology, 3ed—Todd--Wiley
10. Applied Hydrology – Chow, Maidment, Mays, McGraw-Hill
11. Principles of Hydrology- Ward and Robinson, Tata McGraw Hill
12. Irrigation Engineering - Bharat Singh

### **Term Work**

#### **Assignments (Hydrology and Water Resources Engineering)**

Term work will consist of a journal giving the detailed report on assignments performed and visit report. **(any 8)**

1. Analysis of rainfall data (Double mass curve technique/Missing rainfall data).
2. Marking catchment area on a topo-sheet and working out average annual precipitation and determining yield by various methods.
3. Analytical method of measurement of infiltration
4. Flood frequency studies assuming Gumbel's extreme value distribution.
5. Determination of peak flood discharge in a basin using unit hydrograph technique.
6. Determination of storage capacity of a reservoir using mass curve of inflow and outflow.
7. Application of HEC-RAS for Hydrologic routing.
8. Site visit to Meteorological station
9. Measurement of / video demonstration of evaporation by Pan Evaporimeter
10. Measurement of / video demonstration of infiltration by Infiltrimeter

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301002 Infrastructure Engineering and Construction Techniques**

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

**Unit I - Infrastructure Engineering (06 hours)**

**a) Meaning and scope of Infrastructure Engineering:** Scope of infrastructure engineering in national and global development, Forthcoming infrastructure projects at national and global level, Necessity, advantages and disadvantages of PPP (Public Private Partnership), Salient features of smart city , Bus rapid transit system.

**b) Railways:** Permanent way, Track structure of BG, Functions of rail, Standard rail, Tilting of rail, Coning of wheels, Types of sleepers, Fastenings, Ballast, Modern development in railways- metro rails, mono rails, bullet train.

**Unit II- Railways (06 hours)**

Rail joints, types, evil effects, remedial measures, Welding of rails, Short and long welded rails, Types of gradients, Curves, Grade compensation on curves, Alignment, Super elevation, Equilibrium cant, Equilibrium speed, Maximum permissible limits for cant, Cant deficiency, Cant excess, Speed on curves, Safe speed on curves using Indian railways formula only for fully transition curves, Concept of negative cant, Points, crossings and turnouts- functions, Components, elements of points, Types of crossings and turnouts, Track maintenance: Regular and Periodic. **(Site visit is recommended to learn this topic)**

**Unit III - Construction Techniques (06 hours)**

Necessity of mechanization, Dredging techniques, Use of barges, Dewatering techniques- Well Point system, Vacuum dewatering, Electro osmosis, Underwater drilling and blasting, Grouting methods in soft and hard soil, Diaphragm walls- purpose and construction methods, Prefabrication – applications, advantages and disadvantages.

**Unit IV – Tunneling (06 hours)**

Tunneling, functions & types of tunnel, Criteria for selection of size & shape of tunnels. Pilot tunnel, shaft, addit and portal, Needle beam, NATM, TBM & earth pressure balance method of tunneling in soft soil, Drilling & blasting method of tunneling including various operations like mucking, Drainage in tunneling- Pre drainage and permanent drainage, Ventilation in tunneling- temporary and permanent, Micro tunneling and trenchless tunneling.

**Unit V- Docks & Harbors (06 hours)**

Introduction, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Various components of ports, Break waters- types, comparison, design criteria , methods of construction, Tetra pod, Tri bar, Hexapod, Quay wall, Wet & dry dock, Floating dock, Wharves, Jetties, Types of fenders, Dolphins, Marin railway.

**Unit VI - Construction Equipments****(06 hours)**

Dozers, Power shovels, Excavators, Loaders, Scrapers, Dumpers, Drag line, Clamp shell, Compactors, Pavers, Factors affecting performance, selection of equipment, Various types of hoists and cranes and selection, Boom placers, Simple numerical problems on cycle time and production rate, Economic maintenance & repair of construction equipment.

**Reference books**

1. Construction Planning Methods & Equipment: Puerifoy –Tata MC Graw Hill
2. Construction Equipments & its Management: S.C Sharma, Khanna Publication
3. Railway Engineering, 2/E by Chandra—Oxford University Press
4. Railway Track Engineering: J.S.Mundrey, Tata McGraw Hill
5. Harbour, Dock & Tunnel Engineering: R. Srinivasan
6. Dock & Harbour Engineering: Hasmukh P.Oza & Gautam H.Oza-Charoter Book Stall
7. Construction Project Scheduling & Control, 2ed—Mubarak--Wiley

**University of Pune---TE Civil (2015 Course)---w.e.f. June 2017**  
**301003 Structural Design I**

<b>Teaching scheme</b>	<b>Examination scheme</b>
<b>Lectures: 4 hours/week</b>	<b>In semester exam: 30 marks---1.5 hour Paper</b>
<b>Practical: 4 hours/week</b>	<b>End semester exam: 70 marks—3 hours Paper</b>
	<b>Oral based on T.W. : 50 Marks</b>
	<b>Term Work: 50 Marks</b>

Design shall be based on IS: 800-2007

**Unit I** **(08 hours)**

- a) Types of steel structures, grades of structural steel, various rolled steel sections, relevant IS specifications such as IS:800-2007, IS:808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6), **SP38**. IS:4000- 1992, codes for welded connections (mention code) . Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, classification of cross section such as plastic, compact, semi-compact and slender.
- b) **Tension member:** various cross sections such as solid threaded rod, cable and angle sections. Limit strength due to yielding, rupture and block shear. Design of tension member: using single and double angle sections, connections of member with gusset plate by bolts and welds.

**Unit II** **(08 hours)**

- a) Buckling classification as per geometry of cross section, buckling curves, design of struts in trusses using single and double angle section, connections of members with gusset plate by bolts and welds.
- b) Design of axially loaded column using rolled steel section. Design of built-up column, lacing and battening, connection of lacing/battening with main components by bolts and welds.

**Unit III** **(08 hours)**

- a) Design of eccentrically loaded column providing uniaxial and biaxial bending (check for section strength only).
- b) Design of column bases: Design of slab base, gusseted base, and moment resistant base. (axial load and uni-axial bending)

**Unit IV** **(08 hours)**

- a) Design of laterally supported beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure, low and high shear, check for web buckling, web crippling and deflection.
- b) Design of laterally unsupported beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure and shear, check for deflection.

**Unit V** **(08 hours)**

- a) Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld.
- b) Design of welded plate girder: design of cross section, curtailment of flange plates, stiffeners and connections.



## **Unit VI**

**(08 hours)**

- a) Design of gantry girder: Selection of gantry girder, design of cross section, check for moment capacity, buckling resistance, bi-axial bending, deflection at working load and fatigue strength.
- b) Roof truss: assessment of dead load, live load and wind load, design of purlin, design of members of a truss, detailing of typical joints and supports

### **Term work**

**Term work will consist of the following.**

- A) Four full imperial size drawing sheet showing structural detailing of 16 sketches based on syllabus. (Hand drawn)
- B) Design of industrial building including roof truss, purlin, bracings, gantry girder, column, column base and connections.  
Three full imperial size drawing sheets. (Hand drawn)
- C) Design of welded plate girder, design of cross section, curtailment of flange plates, stiffeners and connections. One full imperial size drawing sheet.

**Site visit is recommended to learn this topic.**

**OR**

- C) Design of building including primary and secondary beams, column, column base and connections. One full imperial size drawing sheet. (Using suitable software)
- D) Two site visits: Report should contain structural details with sketches.

**Oral Examination shall be based on the above term work.**

**Note: 1. Maximum number of students in a group, if any, should not be more than three to five for the term work design assignments.**

**2. Draw any one sheet from (B) and (C) Using suitable software.**

### **Reference Books**

1. Design of Steel Structure by N Subramanian, Oxford University Press, New Delhi.
2. Limit state design of Steel Structure by V L Shah & Gore, Structures Publication, Pune
3. Limit state design in Structural Steel by M.R. Shiyekar, PHI, Delhi
4. Structural Design in Steel—Sarwar Alam, Raz—New Age International Publishers
5. Analysis and Design: Practice of Steel Structures—Karuna Ghosh-- PHI Learning Pvt. Ltd. Delhi
6. Limit state design of steel structures by S K Duggal, Tata McGraw Hill Education, New Delhi.
7. Design of Steel Structures by K. S. Sai Ram, Pearson, New Delhi.
8. Fundamentals of structural steel design M L Gambhir, Tata McGraw Hill Education Private limited, New Delhi.
9. Limit state design of Steel Structure by Ramchandra & Gehlot, Scientific Publishers, Pune.
10. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S S, I.K. International Publishing House, New Delhi

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301004 Structural Analysis II**

Teaching scheme	Examination scheme
Lectures:4 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

**Unit I** **(08 hours)**

- a) Slope-deflection method of analysis: Slope-deflection equations, equilibrium equation of Slope-deflection method, application to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.
- b) Sway analysis of rigid jointed rectangular portal frames using slope-deflection method (Involving not more than three unknowns)

**Unit II** **(08 hours)**

- a) Moment distribution method of analysis: Stiffness factor, carry over factor, distribution factor, application to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.
- b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using moment distribution method (Involving not more than three unknowns).

**Unit III** **(08 hours)**

- a) Fundamental concepts of flexibility method of analysis, formulation of flexibility matrix, application to pin jointed plane trusses (Involving not more than three unknowns).
- b) Application of flexibility method to beams and rigid jointed rectangular portal frames (Involving not more than three unknowns).

**Unit IV** **(08 hours)**

- a) Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix, application to trusses by member approach. Application to beams by structure approach only, (Involving not more than three unknowns).
- b) Application to rigid jointed rectangular portal frames by structure approach only (Involving not more than three unknowns).

**Unit V** **(08 hours)**

- a) Finite Difference Method – Introduction, application to deflection problems of determinate beams by central difference method
- b) Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed frames by substitute frame method, cantilever method and portal method.

**Unit VI** **(08 hours)**

- a) Finite element method: Introduction, discretization, types of elements-1D, 2D, 3D, isoparametric and axisymmetric, convergence criteria, Pascals triangle, direct stiffness method, principal of minimum potential energy, principal of virtual work. (No numerical)
- b) Shape functions: CST elements by using polynomials, 1D, 2D elements by using Lagrange's method

### **Reference Books**

1. Structural Analysis: Deodas Menon---Narosa Publishing House.
2. Structural Analysis: Thandavamoorthy---Oxford University Press.
3. Structural Analysis: A Matrix Approach by Pundit and Gupta, McGraw Hills.
4. Structural Analysis by Hibbler, Pearson Education.
5. Structural Analysis: M. M. Das, B. M. Das---PHI Learning Pvt Ltd. Delhi.
6. Fundamentals of Structural Analysis: 2<sup>nd</sup> ed---West---Wiley.
7. Theory of Structures: Vol. I & II by B. C. Punmia, Laxmi Publication.
8. Theory of Structures: Vol. I & II by Perumull & Vaidyanathan, Laxmi Publication.
9. Fundamentals of Structural Analysis: K. M. Leet, Vang, Gilbert---McGraw Hills
10. Matrix Methods for structural engineering.by Gere, Weaver.
11. Introduction to Finite element method, Dr. P.N. Godbole, New Age Publication, Delhi.
12. Finite element Analysis, S.S. Bhavikatti, New Age Publication, Delhi.
13. Basic Structural Analysis: Wilbur and Norris.

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301005 Fluid Mechanics-II**

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

**Unit I** **(8 hours)**

**a) Fluid Flow around Submerged Objects:** Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Drag on sphere, cylinder, flat plate and Aerofoil, Karman's vortex street, Effects of free surface and compressibility on drag, Development of lifts, Lift on cylinder and Aerofoil, Magnus effect, Polar diagram.

**B) Unsteady Flow:** Types of unsteady flow; Flow through openings under varying head, Fluid compressibility, Celerity of elastic pressure wave through fluid medium; Water hammer phenomenon; Rise of pressure due to water hammer, Surge Tanks and their functions.

**Unit -II** **(08 hours)**

**a) Introduction to Open channel flow:** Classification of channels, and Channel flows. Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, One dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, Introduction to notches and weirs ((Rectangular, Triangular, Trapezoidal).

**b) Depth-Energy Relationships in Open Channel Flow:**

Specific energy, Specific force Specific energy diagram, Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent; Critical flow computations; channel transitions

**Unit -III** **(08 hours)**

**a) Uniform flow in open channels :** Characteristics and establishment of uniform flow, uniform flow formulae :Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections (rectangular, triangular, trapezoidal and circular).

**b) Hydraulic Jump-**Phenomenon of hydraulic jump; Location and examples of occurrence of hydraulic jump; Assumptions in the theory of hydraulic jump; Application of momentum equation to hydraulic jump in rectangular channel: Conjugate depths and relations between conjugate depths. Energy dissipation in hydraulic jump; Graphical method of determination of energy dissipation, Classification of hydraulic jump; Practical uses of hydraulic jump, venture flume, standing wave flume

**Unit -IV** **(08 hours)**

**a) Impact of Jet:** Force and work done due to impact of jet on stationary and moving, flat and curved surfaces using linear momentum principle.

b) **Centrifugal Pumps:** General classification of pumps, Centrifugal pumps- Classification, theory working, Selection of pumps, Centrifugal head, Work done by impeller, Heads and efficiencies, minimum starting speed, Cavitation in centrifugal pumps, multistage pumping, Introduction to submersible pumps and reciprocating pumps,

#### **Unit -V**

**(08 hours)**

a) **Hydropower generation:** Elements of hydropower plant; hydraulic turbines- Classification, heads and efficiencies, Design and governing of Pelton Wheel, Francis turbine-parts and working. Cavitation in hydraulic turbines- **Site visit is recommended to learn this topic.**

b) **Performance of hydraulic turbines:** Prediction of performance in terms of unit quantities and specific quantities, Specific speed, Characteristic curves, Dimensional analysis as applied to hydraulic turbines, selection of turbines

#### **Unit-VI**

**(08 hours)**

a) **Gradually Varied Flow in Open Channels-**Definition and types of non-uniform flow; Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF; Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their occurrence; Control section

b) **Gradually varied flow computations:** Methods of GVF computations. Direct Step method, Graphical Integration method, Standard Step method, VenTe Chow method.

#### **Oral**

The Oral is based on the term work which consists of a journal giving the detailed report on experiments and assignments performed and visit report.

#### **List of Experiments**

Following experiments and assignments shall be performed.

##### **A) Experiments (All compulsory, Fluid Mechanics II)**

1. Flow around a Circular Cylinder/Aerofoil
2. Study of Uniform Flow Formulae of Open channel.
3. Velocity Distribution in Open Channel Flow.
4. Calibration of Standing Wave Flume/Venturi flume
5. Study of Hydraulic Jump as Energy Dissipater. 6. Impact of Jet on flat plate and curved vane
7. Characteristics of a Pelton Wheel
8. Characteristics of a Centrifugal Pump
9. Calibration of Notch

##### **B) Assignments (All compulsory, Fluid Mechanics II):**

- (a) Graphical determination of energy loss in Hydraulic Jump.
- (b) Assignment on GVF computation using Direct Step and VenTe Chow method.

**C) Report on Site visit to Hydropower generation plant/Research Institute.**

**Reference Books**

1. Engineering Fluid Mechanics by Garde, Mirajgaonkar, Scitech
2. Hydraulics and Fluid Mechanics by P. N. Modi & S. N. Seth Standard book house
3. Open Channel Flow by K Subramanya, TMH, Third Ed.
4. Open Channel Hydraulics: Venkatesh Chow - Tata McGraw Hill.
5. Open Channel Flow: K. G. RangaRaju - Tata McGraw Hill.
6. Fluid Mechanics- Fundamental and Applications by Cengel and Cimbala- McGraw Hill
7. Flow through Open Channels—Srivastava-- Oxford University Press
8. A text book of Fluid mechanics and Machinery by Bansal
9. Fluid Mechanics by Streeter, Wylie and Bedford – Tata McGraw Hill
10. Fluid Mechanics by White – Mc-Graw Hill
11. Fluid Mechanics-A.K.Mohanty- PHI Learning PvtLtd.Delhi
12. Open Channel Flow by M. M. Das - PHI Learning PvtLtd.Delhi

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301006 Employability Skills Development**

<b>Teaching scheme</b>	<b>Examination scheme</b>
<b>Practical: 2 hours/week</b>	<b>Term Work: 50 Marks</b>

**How to handle this course? (02 hours)**

This course has been introduced with the objective of enhancing the employability of the students through development of their skills. Following topics and their contents are expected to be explored through following 10 activities.

1. Expert lectures 2.Group discussions 3.Case study analysis 4.Group presentations 5.Company and corporate visits 6.Mock interviews and exercises 7.Demo presentations 8. Audio-video shows 9. Use of e-resources 10.Games.

The term work will consist of detailed report of any 8 out of above 10 activities. The activities which need to be performed in a group will have a group of not more than 6 students. However, the report for the term work will be prepared at individual level.

**Unit I (02 hours)**

**a) What is Employability?** What are Employability Skills? Focus on what skills do employers expect from graduates? Career planning with action plan.

**Unit –II (02 hours)**

**b) Interpersonal Skills-**Critical Thinking, Assertiveness, Decision Making, Problem Solving, Negotiation, Building Confidence, Time Management, Personal Presentation, Assertiveness, Negotiation, Avoiding Stress.

**Unit –III (02 hours)**

**c) Presentation Skills-**Presentation Skills What is a Presentation? Writing Your Presentation Coping with Nerves

**Unit –IV (02 hours)**

**d) Communication Skills-**Verbal Communication, Written Communication, Difference between C.V. Bio data and Resume

**Unit –V (02 hours)**

**e) Commercial Awareness-**Professional etiquettes and manners, Global negotiating and Persuading, Integrity. Global trends and statistics about civil engineering businesses.

**Unit-VI****(02 hours)**

**f) Personal skills**-Leadership, Ability to work in a team, Conceptual ability, Subject Knowledge and competence, Analysing and investigating, Planning, Flexibility, Self, Lifelong Learning, Stress Tolerance, Creativity

**Reference Reading**

1. Cambridge English for Job Hunting—Colm Downes---Cambridge University Press (ISBN-978-0- 521-14470-4)
2. Polyskills--Foundation books-- Cambridge University Press—(ISBN 978-81-7596-916-2)
3. Global Business Foundation Skills-- Foundation books-- Cambridge University Press—(ISBN 978-81-7596-783-0)

**E-Resources**

[www.skillsyouneed.com/general/employability-skills.html](http://www.skillsyouneed.com/general/employability-skills.html)  
[www.kent.ac.uk/careers/sk/top-ten-skills.htm](http://www.kent.ac.uk/careers/sk/top-ten-skills.htm)  
[www.skillsyouneed.com/general/employability-](http://www.skillsyouneed.com/general/employability-)  
[www.fremont.k12.ca.us/cms/lib04/.../Domain/.../employability-skills.pdf](http://www.fremont.k12.ca.us/cms/lib04/.../Domain/.../employability-skills.pdf)



**Savitribai Phule Pune University**  
**TE Civil (2015 Course)---w.e.f. June 2017**  
**301007 Advanced Surveying**

Teaching scheme	Examination scheme
<b>Lectures: 3 hours/week</b>	<b>In semester exam: 30 marks---1 hour Paper</b>
<b>Practical: 2 hours/week</b>	<b>End semester exam: 70 marks—2.5 hours Paper</b>
	<b>TW: 50 Marks</b>

**Unit-I Geodetic Surveying & SBPS**

**(06 hours)**

a) Objects, Methods of Geodetic Surveying, Introduction to triangulation, Classification of triangulation systems, Triangulation figures, Concept of well-conditioned triangle, selection of stations, Intervisibility and height of stations.

b) Introduction to SBPS; Positioning with SBPS - Absolute & Differential methods, Use of SBPS in Surveying, SBPS Co-ordinates & heights, Factors governing accuracy in SBPS positioning, Different types of errors in SBPS positioning. Earth ellipsoid, Geodetic datum and Co-ordinate systems, Applications of GPS in civil engineering.

**Unit-II Hydrographic Surveying**

**(06 hours)**

Objects, Applications, Establishing controls, Shore line survey, Sounding, Sounding equipment, Methods of locating soundings – conventional and using GPS, Reduction of soundings, Plotting of soundings, Nautical sextant and its use, Three point problem and its use, solution of three point problem by all methods, Tides and tide gauges, determination of MSL

**Unit-III Remote Sensing and Geographical Information System**

**(06 hours)**

a) Remote Sensing introduction, Definition, Necessity, Importance and use; Basic concepts in Remote Sensing , Basic Laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter, Resolution in remote sensing, Satellite remote sensing, Problems confronting remote sensing system. Ideal and Real remote sensing systems. Space platforms for remote sensing: Imaging sensors and techniques. Image interpretation:- Visual image processing & Digital image processing. Applications of remote sensing. Introduction to LIDAR & Underground utility survey. Comparison between aerial photograph and satellite image.

b) Geographical Information System -Introduction, Definition, Objectives, Components (people, procedure, hardware, software & data) & functions ( input, manipulation, management, query & analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of aspatial data. Applications of GIS such as visibility analysis, Slope analysis, Watershed analysis & Preparation of thematic maps. Limitations of GIS,

**Unit -IV Triangulation Adjustment**

**(06 hours)**

Kinds of errors, Laws of weights, Determination of most probable values (MPV) of conditioned and independent quantities, Method of least squares, Indirect observations, Probable error and its determination, Distribution of error to the field measurements, Normal equation, Method of correlates. Station and figure adjustment of geodetic quadrilateral without central station.

Spherical triangle, Calculations of spherical excess and sides of spherical triangle.

**Unit – V Aerial Photogrammetry (06 hours)**

Objects, Classification- qualitative & quantitative photogrammetry, Applications, comparison of Map and aerial photograph, Vertical, Tilted and Oblique photographs, Scale of vertical photograph, Relief displacement in vertical photograph, Flight planning, Stereoscopic parallax & its measurement by parallax bar.

Mirror stereoscope, Differential height from differential parallax, Ground control points (GCPs), Introduction to digital photogrammetry, different stereo viewing techniques in digital photogrammetry, Method of creation of elevation data, Different products of digital photogrammetry.

**Unit –VI Trigonometric Levelling and Setting out works (06 hours)**

a) Trigonometric Levelling :- Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations.

b) Setting out of Construction works:- Setting out of a bridge, Determination of the length of the central line and the location of piers. Setting out of a tunnel – Surface setting out and transferring the alignment underground.

**Term work**

Term work shall consist of the following practicals and project.

**Geodetic Surveying and Trigonometrical levelling (any three)**

1. Measurement of horizontal and vertical angles with 1” theodolite.
2. Determination of elevation of inaccessible objects by trigonometrical levelling.
3. Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout .
4. Establishing control station using single or dual frequency GPS receiver

**Hydrographic Surveying (any two)**

1. Study and use of nautical sextant and measurement of horizontal angles
2. Plotting of river cross-section by hydrographic surveying
3. Solution to three point problem by analytical method

**Aerial Photogrammetry ( any two)**

1. Study of aerial photograph and finding out the scale of the photograph.
2. Determination of air base distance using mirror stereoscope.
3. Determination of difference in elevation by parallax bar.

**Remote Sensing and GIS (any two)**

1. Study and applications of different RS data products available with National Remote Sensing Centre (NRSC)
2. Use of RS images and visual interpretation
3. Use of interface and tools in GIS software such as GRAM++ or QGIS or equivalent software.

**Project: (Any one)**

1. Adjustment of geodetic quadrilateral without central station by method of correlates.
2. Field survey (500 sq.m.) using Differential GPS (Control as well as mapping).

**Reference Books**

1. Surveying & Levelling, 2/E—Subramanian—Oxford University Press
2. Surveying: Vol. II. and III by Dr. B. C. Punmia : Laxmi Publication - New Delhi.
3. Surveying and Levelling Vol. II by T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
4. GPS Sattelite Surveying—Alfred Leick—Wiley
5. Remote sensing and Geographical Information System, By A. M. Chandra and S. K. Ghosh, Narosa Publishing House.
6. Remote Sensing & GIS, 2/E—Bhatta-- Oxford University Press
7. Principles of Geographical Information System—Burrough-- Oxford University Press
8. Surveying—M.D.Saikia—PHI Learning Pvt .Ltd.Delhi
9. Advanced Surveying -Total Station, GIS and Remote Sensing by SatheeshGopi, R.Sathikumar and N. Madhu , Pearson publication
10. Surveying Vol. 2 by S. K. Duggal, McGraw Hill Publication
11. Remote sensing & image interpretation, Lillesand& Kiefer, John wiley Pub.
12. Surveying &levelling by R. Subramanian, Oxford Publication.

**Suggested Reading**

Bureau Gravimetrique International (BGI)  
International GPS Service for Geodynamics (IGS)  
International Association of Geodesy (IAG)  
International Federation of Surveyors (FIG)  
Permanent Service for Mean Sea Level (PSMSL)  
Commission X Global and Regional Geodetic Networks  
[www.nrsa.gov.in](http://www.nrsa.gov.in)  
[www.iirs-nrsa.gov.in](http://www.iirs-nrsa.gov.in)  
[www.surveyofindia.gov.in](http://www.surveyofindia.gov.in)

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301008 Project Management and Engineering Economics**

Teaching scheme	Examination scheme
<b>Lectures: 4 hours/week</b>	<b>In semester exam: 30 marks---1 hour Paper</b>
	<b>End semester exam: 70 marks—2.5 hours Paper</b>

**Unit I** **(8 hours)**

**Introduction to project management**

Importance, Objectives & Functions of Management , Principles of Management, Categories of Project, Project Failure, Project--- Life Cycle Concept and Cost Components, Project Management Book of Knowledge {PMBOK} – Different Domain Areas, Project management Institute and Certified Project Management Professionals (PMP). Importance of organizational Structure in Management- Authority / Responsibility Relation, Management by objectives (MBO)

**Unit –II** **(08 hours)**

**Project planning and scheduling**

WBS – Work Breakdown Structure, Gantt/Bar chart & its Limitations, Network Planning, Network analysis, C. P. M.- . Activity on Arrow (A.O.A.), Critical path and type of Floats, Precedence network analysis ( A.O.N. ), Types of precedence relationship, P. E. R.T. Analysis

**Unit –III** **(08 hours)**

**Project Resources and Site Planning**

Objectives of Materials Management – Primary and Secondary Material Procurement Procedures - Material requirement - raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping – Use of Excel Sheets, ERP Software, Inventory Control - ABC analysis, EOQ, Introduction to Equipment Management – Fleet Management, Productivity Studies, Equipment Down Time, Sizing - Matching , Site Layout and Planning, Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs

**Unit –IV** **(08 hours)**

**Project Monitoring and Control**

Resource Allocation – Resource Smoothing and Levelling, Network Crashing – Time- Cost – Resource optimization, Project Monitoring - Methods, Updating and Earned Value Analysis, Introduction to use of Project Management Softwares – MS Project / Primavera, Case study on housing project scheduling for a small project with minimum 25 activities.

**Unit –V** **(08 hours)**

**Project Economics**

Introduction to Project Economics - Definition, Principles, Importance in Construction Industry, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Annuities, Demand, Demand Schedule, Law of Demand, Demand Curve, Elasticity of Demand, Supply, Supply Schedule, Supply Curve, Elasticity of Supply Equilibrium, Equilibrium Price, Equilibrium Amount, Factors affecting Price Determination, Law of Diminishing Marginal Utility, Law of Substitution, Concept of Cost of Capital, Time Value of Money, Sources of Project Finances –

Concepts of Debt Capital and Equity Capital. Types of Capital – Fixed and Working, Equity Shares and Debenture Capital, FDI in Infrastructure

#### **Unit-VI**

**(08 hours)**

#### **Project appraisal**

Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component], Study of Project Feasibility report and Detailed Project Report (DPR), Role of Project Management Consultants in Pre-tender and Post-tender.

#### **Reference Books**

1. Project Management—Khatua—Oxford University
2. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Management and Planning by B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.
6. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
7. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301009 Foundation Engineering**

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

**Unit-I**

**Subsurface Investigations for Foundations**

**(06 hours)**

Purpose and planning of subsurface exploration. Methods of Investigation: Trial pits, borings, depth & number of exploration holes, core recovery, RQD, Core Log. Geophysical methods– Seismic refraction and Electrical resistivity method. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field tests- SPT, N value correction and significance, DCPT, SCPT and introduction of advanced testing techniques like Pressure meter test. **Site visit is recommended to learn this topic.**

**Unit-II**

**Bearing capacity and Shallow Foundation**

**(06 hours)**

Basic definitions, Modes of shear failure, bearing capacity analysis- Terzaghi's, Hanson's, Meyerhof's, Skempton's, Vesics equations and IS code method - Rectangular and Circular footings. Bearing Capacity evaluation: - Plate Load Test and SPT. Housel's perimeter shear concept. Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Shallow foundation- Types and Applications. Floating foundation. Presumptive bearing capacity.

**Unit-III**

**(06 hours)**

**a) Settlement and Consolidation Settlement:** - Introduction, Causes of settlement. Pressure bulb, Contact pressure, Significant Depth of foundation, Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, Consolidation settlement. Use of Plate Load test and SPT in settlement analysis. Allowable soil pressure.

**b) Consolidation** - Introduction, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- Square root of time fitting method and logarithm of time fitting method. Time factor. Rate of settlement and its applications in shallow foundation. Introduction of Normal consolidation, over consolidation and Preconsolidation pressure.

**Unit-IV**

**(06 hours)**

**Deep Foundations**

Introduction, Pile classification, Pile installation-Cast in-situ, driven and bored pile, Load carrying capacity of pile by static method, Dynamic methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action- Feld rule. Rigid Blocks method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition, Types and uses. Well foundation: components, sand Island method.

## Unit V

(06 hours)

### Cofferdams and Foundation on Black Cotton Soils

**a) Cofferdams:** Types and concepts of Steel Sheet Piles and Precast Concrete Piles, Interlocking Circular Piles, RC Diaphragm wall method.

**b) Foundation on Black Cotton Soils:** Characteristics of black cotton soil, swelling potential and its evaluation methods, Engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed piles- Design principles and its construction Techniques. Stone Columns prefabricated vertical Drains, Preloading technique, and vibro flotation technique.

## Unit VI

(06 hours)

### Soil Reinforcement and Earthquake Geo-techniques

**a) Soil Reinforcement:** Basic components and Mechanism of reinforced soil. Geosynthetics: type's, functional properties and requirements. Geosynthetic Applications in Civil Engineering.

**b) Earthquake Geo-techniques** Introduction, Earthquake Terminology, Sources of earthquake, Seismic zones of India, Magnitude of an earthquake, Intensity of earthquakes, Effect of ground motion on structures, General principles of earthquake resistant design. Liquefaction Phenomenon.

## Reference Books

1. Dr. B. J. Kasmalkar, "Foundation Engineering", Pune Vidyarthi Griha Prakashan, Pune
2. Gopal Ranjan and A. S. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, (2010)
3. Dr. B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publications.
4. Soil Mechanics- T. William Lambe--Wiley
5. J. E. Bowels, "Foundation Analysis and Design", McGraw-Hill
6. Foundation Engineering- P. C. Varghese-- PHI Learning Pvt. Ltd.
7. Soil Mechanics and Foundation Engineering- V. N. S Murthy, Marcel Dekker, Inc. Newyork.
8. Soil Mechanics & Foundation Engineering - Rao --Wiley
9. A. K. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers, 2009.
10. Engineering in Rocks for Slopes. Foundations and Tunnels - T Ramamurthy - PHI Learning
11. Geotechnical Engineering by Conduto, PHI, New Delhi.
12. Foundation Design Manual: N V Nayak, Dhanpat Rai Publications.
13. International Steven Kramer, "Geotechnical Earthquake Engineering", Prentice Hall Publications.
14. Practical Handbook of Grouting: Soil-Rock and Structures---James Warner--Wiley
15. IS 1892, 1893, 2911, 6403, SP36 (PART-II)

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301010 Structural Design –II**

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 4 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Term Work: 50 Marks, Oral Based on T.W.: 50 Marks

**Unit I** **(8 hours)**

Introduction to various design philosophies R.C structures: Historical development, Working stress method, Ultimate load method and Limit state method.

**a) Working stress method:** Moment of resistance of singly reinforced rectangular R.C. sections, Under reinforced, Balanced and Over reinforced sections. Moment of resistance of doubly reinforced rectangular sections.

**b) Limit state method:** Limit state of collapse, Limit state of serviceability and Limit state of durability. Characteristic strength, Characteristic load, concept of Safety - Probabilistic approach, Semi probabilistic approach. Partial safety factors for material strengths and loads. Study of Structural Properties of Concrete.

**Unit II** **(8 hours)**

**a)** Assumptions of Limit State Method, Strain variation diagram, Stress variation diagram, Design parameters for singly reinforced rectangular R.C. section, Moment of resistance of under reinforced and balanced section, M.R. of doubly reinforced rectangular section and flanged section.

**b) Design of slab:** One way, Simply supported, Cantilever and Continuous slabs by using IS code coefficients.

**Unit III** **(8 hours)**

**a) Design of slab:** Two way slabs: Simply supported, Continuous and Restrained.

**b) Design of staircase:** Dog legged and Open well.

**Unit IV** **(8 hours)**

**Design of flexural members:** Simply supported, Continuous, Cantilever beams (singly reinforced, doubly reinforced and flanged) for flexure.

**Unit V** **(08 hours)**

**Design of flexural members:**

**a) Design of flexural members:** For Shear, Bond and Torsion.

**b) Design of flexural members:** Redistribution of moments in continuous reinforced concrete beam.

**Unit VI** **(08 hours)**



a) **Column:** Introduction, Strain and Stress variation diagrams, axially loaded Short Column with minimum eccentricity requirements. Design of Short Column for axial load, Uni-axial, Biaxial bending using interaction curves.

b) Design of Isolated Column footing for axial load and uni-axial bending .

### **Term work**

#### **Design Assignments**

- a) Design of G + 2 (Residential/Commercial/Public) building covering all types of Slabs, Beams, Columns, Footings and Staircase (first and intermediate flights).
  - i. Minimum plan area of each floor shall be more than 150 m<sup>2</sup>.
  - ii. Design of all plinth and ground beams.
  - iii. Design of all slabs, beams of first floor.
  - iv. Design of three types columns for, (a) axial load, (b)axial load + uniaxial BM, (c)axial load + biaxial BM ), from terrace level to footing along with detailed load calculations and footing for columns with (a) axial load (b)axial load + uniaxial BM
  - v. Design any one element by using spread sheet.
  - vi. Detailing of reinforcement should be as per SP-34 & IS 13920
  - vii. Full imperial drawing sheets in four numbers. Out of which only structural plan drawing sheet shall be drawn by using any drafting software.
- b) Reports of two site visits. (Building under construction)

**Oral Examination shall be based on the above term work.**

**Note: Maximum number of students for projects not more than Four**

#### **Reference Books**

1. "Illustrated Reinforced Concrete Design" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications', Pune 411009
2. "Illustrated Design of Reinforced Concrete Buildings (G+3)" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications', Pune 411009.
3. "Design of Reinforced Concrete Structures" by Subramanian, 'Oxford University Press'.
4. "Limit State Analysis and Design" by P. Dayaratnam, 'Wheeler Publishing company', Delhi.
5. "Comprehensive Design of R.C. Structures" by Punmia, Jain and Jain, 'Standard Book House', New Delhi.
6. "RCC Analysis and Design" by Sinha, S, Chand and Co. New Delhi.
7. "Reinforced Concrete Design" by Varghese, PHI, New Delhi.
8. "Reinforced Concrete Design" by Pillai Menon, 'Tata McGraw Hill', New Delhi.
9. "Design of Concrete Structure" by J N Bandyopadhyay, PHI, New Delhi.

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301011 Environmental Engineering-I**

Teaching scheme	Examination scheme
<b>Lectures: 4 hours/week</b>	<b>In semester exam: 30 marks--1 hour Paper</b>
<b>Practical: 2 hours/week</b>	<b>End semester exam: 70 marks—2.5 hours Paper</b>
	<b>Practical Exam: 50 Marks</b>

**Unit-I** **(08 hours)**

**A) Noise Pollution:** Sound measurements – Sound pressure, Intensity, Sound pressure level, Loudness, Equivalent noise level and Cumulative noise level.

**B) Air Pollution:** Atmospheric stability, Mixing heights, Meteorological parameters.

Air pollution control mechanism. Equipment for particulate contaminants. Principle and working of Settling chamber, Cyclone, Fabric filter, ESP. Gaseous contaminants control by adsorption and absorption technique.

**C) Municipal Solid Waste:** Concept of Municipal Solid waste management, Sources, Classifications, Treatment (composting & anaerobic digestion) Disposal (sanitary land fill)

**Unit -II** **(08 hours)**

**A) Introduction to water supply scheme:** Data collection for water supply scheme, Components and layout. Design period, Factors affecting design period.

**B) Quantity:** Rate of water consumption for various purposes like domestic, Industrial, Institutional, Commercial, Fire demand and Water system losses, Factors affecting rate of demand, Population forecasting.

**C) Quality:** Physical, Chemical, Radioactivity and Bacteriological Characteristics, Heavy metals. Standards as per IS: 10500 (2012)

**Unit –III** **(08 hours)**

**A) Water treatment:** Principles of water treatment operations and processes, Water treatment flow sheets.

**B) Aeration:** Principle and Concept, Necessity, Methods, Removal of taste and odour. Design of aeration fountain.

**C) Sedimentation:** Plain and chemical assisted - principle, efficiency of an ideal settling basin, Settling velocity, Types of sedimentation tanks, Design of sedimentation tank. Introduction & design of tube settlers.

**Unit -IV** **(08 hours)**

**A) Coagulation and flocculation:** Principle of coagulation, Common coagulants alum & ferric salts, Introduction to other coagulant aids like bentonite clay, Lime stone, Silicates and Polyelectrolytes, Introduction of natural coagulants, Mean velocity gradient “G” and Power consumption, Design of Flocculation chamber, Design of Clari-flocculator.

**B) Filtration:** Theory of filtration, Mechanism of filtration, Filter materials, Types: Rapid, Gravity, Pressure filter, Multimedia and dual media filters, Components, Under drainage system, Working and cleaning of filters, Operational troubles, Design of Rapid sand Gravity filters.

#### **Unit -V**

**(08 hours)**

**A) Disinfection:** Mechanism, Factors affecting disinfection, Types of disinfectants, Types and methods of chlorination, Break point chlorination, Bleaching powder estimation.

**B) Water softening methods and Demineralization :** lime-soda, Ion-Exchange, R.O. and Electrodialysis

**C) Fluoridation and defluoridation.**

#### **Unit-VI**

**(08 hours)**

**A) Water distribution system:** System of water supply- Continuous and intermittent system. Different distribution systems and their components. ESR- Design of ESR capacity. Wastage and leakage of Water- Detection and Prevention.

**B) Rainwater harvesting:** Introduction, need, methods and components of domestic rainwater harvesting system. Design of roof top rainwater harvesting system.

**C) Introduction to Packaged WTP in townships, big commercial plants, necessity (On-site water treatment)**

#### **Term Work**

Note- Any 8 out of 10 Practicals. (a ,b & c are compulsory.)

##### **a) Practicals.**

1. pH and Alkalinity of raw water, soft drinks & tea.
2. Total hardness and components of raw water.
3. Chlorides in water.
4. Chlorine demand and residual chlorine.
5. Sodium or Potassium or Calcium using flame photometer.
6. Turbidity and optimum dose of alum.
7. Fluorides or Iron contents in water.
8. Most Probable Number (MPN)
9. Ambient air quality monitoring for PM10/PM2.5,SO2 & NO<sub>x</sub>.
10. 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 and Detailed Report.**

- c) Assignment 1. Study of Water intake structures.  
2. Complete Design of WTP using appropriate software.

## **Text / Reference Books**

### **Reference Books:**

1. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications.
2. Optimal Design of Water Distribution Networks: P. R. Bhave, Narosa Publishing House.
3. Rain Water Harvesting: Making water every body's business by CSE (Centre for Science and Environment) [www.cse.org](http://www.cse.org)
4. Harvesting Faith: Linda K. Hubalek. Published by Butterfield books.
5. CPHEEO Manual on Water Supply & Treatment.
6. Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association).

### **Text Books:**

1. Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.
3. Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
4. Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications.
5. Theory and practice of water and waste water treatment--Wiley
6. Water Supply and Treatment Manual: Govt. of India Publication.
7. Waste Water Treatment-Concept Design and Approach---C.L.Karia,R.A.Christian--PHI
8. Environmental Remote Sensing from Regional to Global Scales—Ed.Giles Foody—Wiley
9. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.

### **Suggested Reading:**

- Environmental Engineering by N. N. Barak , MGH
- Environmental Engineering by Venugopal Rao, PHI
- Environmental Engineering by Steel, McGhee , MGH
- Water Supply & Engineering by Pande and Carne , Tata McGraw Hill
- Water Supply Engineering by Harold Eaton Babbit & James Joseph Doland , MGH
- Principles of Water Treatment by Keny J. Howe, MWH.
- Water treatment : principles & Design 3rd edition by John C Crittenden R. Rhodes
- Water quality & Treatment : Handbook on Drinking Water 6th Edition by James K. Edzwald.
- Standard Methods, APHA, AWWA.
- Environmental Engineering Laboratory Manual by B. Kotain & Dr. N. Kumarswamy
- NEERJ Laboratory Manual

**Savitribai Phule Pune University**  
**TE Civil (2015 Course) w.e.f. June 2017**  
**301012 Seminar**

<b>Teaching scheme</b>	<b>Examination scheme</b>
<b>Practical: 1 hour/week</b>	<b>Oral Exam: 50 Marks</b>

Oral examination shall be conducted based on a Seminar report to be prepared by each individual. The seminar report should contain the following.

1. Introduction of the topic, its relevance to the construction industry, need for the study, aims and subjectives, limitations.
2. Literature review from books, journals, conference proceedings, published reports / articles / documents from minimum 8 references.
3. Theoretical chapter on the topic of study, advantages and limitations.
4. Photographs from web search / experiments done / projects visited / organizations visited for studying documents / procedures/ systems / materials/ equipment/ technologies used.
5. Ongoing research areas, information, about commercial vendors, information on benefit – cost aspects.
6. Concluding remarks with respect to commercial/ practical and social applications.
7. References in standard format.

Note:- In order to arouse the interest of students and engage them in active learning, mini-projects/ complex problems may be given in groups of maximum 4students, covering different aspects involved in Civil engineering so as to also enable the students to submit separate individual reports as required above.

Internal guides may prepare a continuous evaluation sheet of each individual and refer it to the external examiner for consideration.

The oral examination of each individual may then be conducted as per the practice adopted for other subjects.