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

Semester I

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<tr>
<th>Course Code</th>
<th>Course</th>
<th>Teaching Scheme hour/week</th>
<th>Semester Examination Scheme of marks</th>
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## Semester II

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<td>301008</td>
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Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301001 Hydrology and Water Resource Engineering

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Unit – I

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


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

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
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
3. Irrigation and water power Engineering- Dr. Punnia and Dr. Pande, Standard Publisher
4. Elementary Engineering Hydrology- M.J.Deodhar-Pearson Education
5. Engineering Hydrology. –Ojha—Oxford University Press
7. Hydrology- Principles, Analysis and Desin, Raghunath, New Age International
8. Irrigation Engineering-Raghunath--Wiley
10. Applied Hydrology – Chow, Maidment, Mays, 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.
8. Site visit to Meteorological station
9. Measurement of / video demonstration of evaporation by Pan Evaporimeter
10. Measurement of / video demonstration of infiltration by Infiltrometer
Savitribai Phule Pune University TE Civil (2015 Course) w.e.f. June 2017 301002
Infrastructure Engineering and Construction Techniques

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<td>End semester exam: 70 marks—2.5 hours Paper</td>
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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
2. Construction Equipments & its Management: S.C. Sharma, Khanna Publication
3. Railway Engineering, 2/E by Chandra—Oxford University Press
5. Harbour, Dock & Tunnel Engineering: R. Srinivasan
7. Construction Project Scheduling & Control, 2ed—Mubarak—Wiley
University of Pune---TE Civil (2015 Course)---w.e.f. June 2017
301003 Structural Design I

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<td>Practical: 4 hours/week</td>
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<td>Oral based on T.W. : 50 Marks</td>
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<td>Term Work: 50 Marks</td>
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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 consists 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 sheets.

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 sheets. (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. Shiyeekar, 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
7. Design of Steel Structures by K. S. Sai Ram, Pearson, New Delhi.
9. Limit state design of Steel Structure by Ramchandra & Gehlot, Scientific Publishers, Pune.
Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301004 Structural Analysis II

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**Unit I**

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| 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**

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| 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**

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| 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**

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| 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**

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| 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
4. Structural Analysis by Hibbler, Pearson Education.
11. Introduction to Finite element method, Dr. P.N. Godbole, New Age Publication, Delhi.
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**

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**

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.
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
3. Open Channel Flow by K Subramanaya, TMH, Third Ed.
7. Flow through Open Channels—Srivastava-- Oxford University Press
8. A test book of Fluid mechanics and Machinery by Bansal
Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301006 Employability Skills Development

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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**


**E-Resources**

www.skillsyouneed.com/general/employability-skills.html
www.kent.ac.uk/careers/sk/top-ten-skills.html
www.skillsyouneed.com/general/employability-
www.fremont.k12.ca.us/cms/lib04/.../Domain/.../employability-
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### Teaching scheme

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### Examination scheme

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### Unit-I Geodetic Surveying & SBPS

**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

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


**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

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

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

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.

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
4. GPS Satellite Surveying—Alfred Leick—Wiley
8. Surveying—M.D.Saikia—PHI Learning Pvt .Ltd.Delhi

Suggested Reading

Bureau Gravimetric 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
www.iirs-nrsa.gov.in
www.surveyofindia.gov.in
Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301008 Project Management and Engineering Economics

<table>
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<th>Teaching scheme</th>
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<td>Lectures: 4 hours/week</td>
<td>In semester exam: 30 marks---1 hour Paper</td>
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<td>End semester exam: 70 marks—2.5 hours Paper</td>
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Unit I

Introduction to project management

Unit II

Project planning and scheduling

Unit III

Project Resources and Site Planning

Unit IV

Project Monitoring and Control

Unit V (08 hours) Project Economics

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
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
6. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
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)

Unit-IV

(06 hours)

Deep Foundations
Unit V

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.


Unit VI

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
15. IS 1892, 1893, 2911, 6403, SP36 (PART-II)
Unit I  
(8 hours)
Introduction to various design philosophies R.C structures: Historical development, Working stress method, Ultimate load method and Limit state method.


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 $m^2$.

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

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<td>Practical Exam: 50 Marks</td>
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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**

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 Electro dialysis

C) **Fluoridation and defluoridation.**

**Unit-VI**

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 & NOx.
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:
3. Rain Water Harvesting: Making water every body’s business by CSE (Centre for Science and Environment) www.cse.org
5. CPHEEO Manual on Water Supply & Treatment.

Text Books:
5. Theory and practice of water and waste water treatment--Wiley
8. Environmental Remote Sensing from Regional to Global Scales—Ed.Giles Foody—Wiley

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
- 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

<table>
<thead>
<tr>
<th>Teaching scheme</th>
<th>Examination scheme</th>
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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 subjunctives, 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 4 students, 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.