SYLLABUS

OF

M.E. CIVIL
(Water Resource and Environmental Engineering)
w.e.f.2013
M.E. Civil Engg (Water Resource and Environmental Engineering)  
2013 Course  
University of Pune, Document on Rules and Regulation for P.G.Courses be referred for the detailed information  
1 Credit = 2 modules = 15 Hours  

**COURSE STRUCTURE**  

### SEMESTER I

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Teaching Scheme</th>
<th>Examination scheme</th>
<th>Credits</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Lect./ Practical</td>
<td>Paper</td>
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<tr>
<td>501081</td>
<td>Planning and Management of Water Resources</td>
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<tr>
<td>501082</td>
<td>Environmental Chemistry and Microbiology</td>
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<td>501083</td>
<td>Fluid Mechanics</td>
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<td>501004</td>
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<tr>
<td>501084</td>
<td>Elective I</td>
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<p>|        | Total                                        | 25              | 250                | 250     | 50    | 50    | 600  | 25   |</p>
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<tr>
<th>Code</th>
<th>2 Credits Course</th>
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<th>1 Credit Course</th>
<th>Code</th>
<th>Audit Course (No Credit Course)</th>
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<tbody>
<tr>
<td>501 084A</td>
<td>Cyber Security / Information Security</td>
<td>501 084</td>
<td>Economics &amp; Finance For Engineers</td>
<td>501 084</td>
<td>Mass communication, Photography and Videography</td>
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<tr>
<td>501 084B</td>
<td>Computational Methods</td>
<td>501 084</td>
<td>Foreign Language –I</td>
<td>501 084L</td>
<td>Yoga and Meditation</td>
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<td>501 084C</td>
<td>Energy and Environment</td>
<td>501 084</td>
<td>Engineering Ethics</td>
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<td>501 084D</td>
<td>Remote Sensing and Geographical Information System</td>
<td>501 084</td>
<td>Intellectual Property Rights</td>
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<td>501 084E</td>
<td>Climate change</td>
<td>501 084J</td>
<td>Sanskrit-I</td>
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**SEMESTER –II**

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<th>Examination scheme</th>
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<td>Lect./Practical</td>
<td>Paper / TW / Oral/Present</td>
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<td>Noise Pollution and Control Techniques</td>
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<td>Environmental Geotechnology</td>
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**SEMESTER –III**

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<tr>
<th>Code</th>
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<th>Examination scheme</th>
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<td>Lect./Practical</td>
<td>In Semester Assessment</td>
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601 094 : ELECTIVE –III
Select any combination having total of 5 credits from following technical / interdisciplinary courses ---

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<th>Code</th>
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<td>601 0094A</td>
<td>Optimization Techniques</td>
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<td>Project Funding</td>
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<td>Solid and Hazardous Waste Management</td>
<td>601 0094G</td>
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<td>601 0094D</td>
<td>Industrial Waste Management</td>
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SEMESTER –IV

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<td>Paper TE/Oral/Presentati on</td>
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UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER I
501 081- Planning and Management of Water Resources

Teaching Scheme:
Lectures: 4 Hrs./Week
Credits: 4

Examination Scheme:
Theory Paper: 100 Marks
In Semester Assessment: 50 marks
End Semester Assessment: 50 marks
Duration of end semester theory paper: 3 hrs.

Module 1
Introduction:
Objectives: of water resource planning and management, its Necessity, Aspects of water resources planning, water resource development; needs and opportunities; social goals

Module 2
Spatial and temporal characteristics of water resources, constraints for its development like non-reversibility; planning region and horizon.

Module 3
Economic Planning: Cost benefit studies of single and multipurpose projects– multi objective planning models, financial analysis of water resources projects, allocation of cost of multipurpose projects; repayment of cost.

Module 4
Demand for drinking water; irrigation, hydropower; navigational; planning for flood control.

Module 5
Management of Water Resources: Characteristics and functions of reservoir; reservoir sedimentation; conservation storage; conflict among uses

Module 6
Reservoir operation studies - Effect on river regime; long term simulation; reliability; resiliency and vulnerability assessment

Module 7
Management of Ground-Water Resources: Ground water evaluation; conjunctive use of surface and ground water.

Module 8
Discounting techniques; benefit cost parameters; estimation of benefits and costs; appraisal criteria; social benefit cost analysis. Basin planning; inter-basin transfer of water

Reference Books
UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER I
501 082- Environmental Chemistry and Microbiology

Teaching Scheme:
Lectures : 4 Hrs./Week
Credits : 4

Examination Scheme:
Theory Paper : 100 Marks
In Semester Assessment: 50 marks
End Semester Assessment: 50 marks
Duration of end semester theory paper: 3 hrs.

Module 1
Chemistry of pollutants in the Atmosphere:
Sources of air pollutant in atmosphere. Characteristic of air pollutant. Zoning of atmosphere, effects of temperature, lapse rate solar radiation and wind current (wind rose diagram) on the various pollutants. Air pollutant sampling technique in ambient air and stack monitoring system. Automobile pollution sampling technique, causes of automobile pollution and control technique.

Module 2
Introduction to Gaussian plume model, plume behaviour. Design the methods for controlling gases pollutant and particulate matter. (Including numerical)

Module 3
Thermodynamics, mass and heat transfer.
Introduction to basics of thermodynamics I & II law, ideal gases, boundary condition. Refrigeration cycle such as vapour compression and vapour absorption system, steam properties.

Module 4
Chemical reaction Different types of chemical reaction, reactor and their characteristics. Basics of mass transfer, absorption and adsorption process, various laws in mass transfer. Conduction, convection and radiation heat transfer and their application. (Including numerical)

Module 5
Physico-Chemical methods for analysis of environmental pollutants and their concentration.

Module 6
Instrumental method of pollutant analysis.
Fundamental of lights, heat, velocity, acceleration, noise and their application in instrument design. Various law for design of environmental instruments. Study of various instruments used in pollution analysis such as pH meter, colorimeter, flame photometer, noise meter, accelerometer, turbidity meter, spectrophotometer single and double beam, AAS, HPLC, GC.

Module 7 Bio kinetics and its applications.
Bio kinetic coefficients, determination of bio kinetic coefficient in lab, application of bio kinetic constant, application of bio kinetic constant in ASP, Trickling filter, Lagoon, Oxidation ponds, UASB, Anoxic treatment, anaerobic digester, septic tank. Design of landfill bioreactor and leachate control in solid waste management. (Including numerical)

Module 8 Micro organism and microbiology in environmental engineering.
Bacteria: classification and characteristics of bacteria, cell morphology, growth rate curve, culture techniques, gram staining, microscopic methods, MPN (Moond’s Expression), Plate count and membrane filter techniques, Algae: classification, symbiosis, factors affecting algal growth, control of algae, fungi, moulds, protozoa, population dynamics, role of microbes, substrate utilization in biological waste treatment, significance of F/M ratio, acclimatization of bacteria, bioassay tests, aerobic and anaerobic metabolism. Structure of prokaryotic and eukaryotic cells.

Reference Books
1) Chemistry for Environmental Engineers - Swayer and McCarty
2) Outlines of Biochemistry - Conn and Stump
3) Microbiology - Pelzar and Reid
4) Microbiology for Sanitary Engineers - Ray MaKinney.
5) Environmental chemistry by A.K Day

UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER I
501 083 - Fluid Mechanics

Teaching Scheme :
Lectures : 4 Hrs./Week
Credits : 4

Examination Scheme:
Theory Paper : 100 Marks
In Semester Assessment: 50 marks
End Semester Assessment: 50 marks
Duration of end semester theory paper: 3 hrs.

Module 1
Introduction:
Revision of concepts in basic Fluid Mechanics such as classification of flows, Equation of continuity for three dimensional flow in Cartesian co-ordinates, equation of continuity for one-dimensional flow along a streamline, types of motion, rotational and irrotational motion, velocity potential, stream function and flow net, Euler’s equation of motion along a streamline and its integration, Bernoulli’s equation.

Module 2
Development of boundary layer on a flat plate nominal, displacement, momentum, energy thicknesses, laminar, transitional and turbulent boundary layer, laminar sub layer, Local and mean drag coefficients

Module 3
Kinematics:
Continuity Equation in polar and cylindrical coordinates, solving Laplace equation by graphical & relaxation method, conformal mapping. Standard two dimensional flow pattern, source, sink, doublet and their combination

Module 4
Laminar Flow:
Navier strokes equation-derivation, exact flow between parallel plates-it’s exact solution, flow near an oscillating plate & suddenly accelerated plate.

Module 5
Boundary Layer Theory:
Karman’s momentum integral equation, Karman Pohelhausen’s solution, boundary layer separation
Module 6
Turbulent Flow:
Reynolds’ equation of motion, typical solution, Energy and Momentum equation, Statistical theory of turbulence, Isotropic and homogeneous turbulence, probability density function

Module 7
Fundamentals of Compressible Flow:
Compressible fluid flow-fundamental equation, continuity equation, energy equation, velocity of propagation, Pressure, density and temperature in terms of Mach number,

Module 8
Normal shock in one dimensional compressible flow and compressible flow around immersed bodies

Reference Books
2. Fluid Mechanics- Grade & Mirajgaonkar
3. Fluid Mechanics and Machinery- D. Ramadurgaiah, New age International

UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER I

501 004 : Research Methodology

Teaching Scheme
Lectures: 4 hours/week
Credits 4

Examination Scheme
In semester Exam: 50 Marks
End Sem. Exam. : 50 marks
Duration of end semester theory paper: 3 hrs.

Module 1:
Introduction to Research , Meaning of research , types of research, process of research, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, formulation of research hypotheses. Search for causation

Module 2:
Developing a Research Proposal Format of research proposal, Individual research proposal, Institutional research proposal, Significance, objectives, methodology, Funding for the proposal, Different funding agencies, Framework for the planning

Module 3:
Literature survey- Definition of literature and literature survey, need of literature survey, sources of literature, elements and objectives of literature survey, styles of literature survey, and strategies of literature survey.

Module 4:
Data collection , Measuring, Sampling and Scaling—Classification of data, benefits and drawbacks of data, evaluation of data, qualitative methods of data collection, methods of qualitative research, Sampling, sample size, sampling strategy, attitude measurement and scaling, types of measurements, criteria of good measurements, classification of scales.
Module 5:
**Preliminary data analysis** - Testing of hypothesis- concepts and testing, analysis of variance techniques, introduction to non parametric tests. Validity and reliability. Approaches to qualitative and quantitative data analysis

Module 6:
**Advanced data analysis techniques** - Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling, Descriptive statistics, Inferential statistics, Multidimensional measurement and factor analysis

Module 7:

Module 8:
**Presentation of research** - Research briefing, presentation styles, impact of presentation, elements of effective presentation, Writing of research paper, presenting and publishing paper, patent procedure.

Reference Books:
2. Research Methods for Business—Sekaran Uma and Roger Bougie—Wiley, India
5. Research Methodology: An Introduction’ by Wayne Goddard and Stuart Melville
7. Research in Education---John Best and James Kahn, Prentice Hall of India Pvt.Ltd.

**e-Resource---For class room ppts---www.wileyeurope.com/college/sekaran**

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Module 1:

Module 2:
**Intelligent Property Issues in Cyber space:** Domain names and related issues, Copyright in digital media, Patents in cyber world.

**Rights of Neitzens and E- Governance:** Privacy and freedom issues in cyber world, E-Governance, Cyber crimes and Cyber laws.

Module 3:

Module 4:
**Security Investigation:** Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

**Access Control, Intrusion Detection and Server Management, Firewalls:** Overview of Identification and Authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features


**Reference Books:**

4) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn, 2011

501 084  -B -Elective I  Computational Methods (2Credits course)

Module 1:
Numerical differentiation I:
Partial differential equation Laplace and Poisson’s equation-solution, method of characteristics for solution of initial boundary value problems, relaxation method

Module 2
Numerical differentiation II:
Finite Difference, Gaussian elimination and Gauss, Jordan methods, matrix inversion, Gauss Seidel method –Newton-Raphson method

Module 3
Statistics and Probability:
Moments, Skewness and Kurtosis, Probability, conditional probability, various theoretical distributions like binomial, normal, log-normal, Poisson, gamma distribution, Pearson type I, II & II distribution test of significance, Gumbel distribution, testing of hypotheses – Large sample tests for mean and proportion, Chi-square test

Module 4
Regression and Correlation:
Regression and correlation – rank correlation – multiple and partial correlation – analysis of variance-one way and two way classifications – experimental design – Latin square design.

Reference Books
3.Numerical Methods by Krishna Raju
4.Shanthakumar M.S., Numerical Methods & Analysis

501 084- C- Elective I- Energy And Environment  (2Credits course)

Module 1 Energy Crisis:
Historical events, energy requirement of society in past and present situation, availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability.
Non-conventional energy sources: Hydro power plant, tidal energy, biomass energy, wind energy, hydrogen as a source of energy, energy conversion technologies, their principles, equipment and suitability in context of India. Environmental impacts of these technologies.

**Module 2 Solar Energy Option:**
Sun as source of energy, direct methods of solar energy collection, process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and application, environmental impacts of solar energy.

Biomass Energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, biogas production, biomass gasification process and technologies, environmental impacts of biomass energy. (Including numerical)

**Module 3 Energy Storage:**
Types of energy storage, devices for sensible and latent heat storage, energy storage in dry batteries, nickel-cadmium batteries, secondary heat storage, chemical storage, environmental consequences of energy storage systems (Including numerical)

**Module 4 Energy recovery systems:**
Approaches to waste Energy Utilization, Equipment, Utilization System, objective, principles of heat transfer, Gas to Gas heat transfer, Gas to Liquid heat transfer, Recovery of waste heat in coil coating, Non-conventional liquid fuels, Heat recovery by Cogeneration. (Including numerical)

**Reference Books**
1. Bewik M.W.M. - Handbook of organic waste conversion
2. Bokris J.O. - Energy, the solar hydrogen alternative.
3. Rai G.D - Non-conventional Energy Sources

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**501 084 - D - Elective I - Remote Sensing And Geographical Information System**
(2Credits course)

**Module 1 Concept of remote sensing:**

**Module 2 Satellite Remote Sensing:**
LANDSAT and IRS characteristics, products and FCC, Interpretation Techniques, visual and digital in brief, Recognition of photo elements and terrain elements like size, shape, tone, texture, pattern, shadow etc, Terrain analysis: Relief, landform, drainage pattern

**Module 3**
Use of remote sensing in Lithology, structure and Geomorphology Application of Remote Sensing in Ground Water and Mineral Exploration, Basic Concept of GIS, components, history and applications, Hardware and Software requirements for GIS, Map features, Scale, Resolution, accuracy and data base extent

**Module 4 Map projection and parameters:**
Geographical Coordinate system, types of projection and parameters, projection transformation and mapping in GIS. Geospatial data models: Spatial and non-spatial data, VECTOR and RASTER models.

**GIS Analysis:** Digitalization, editing and structuring of map data, overlay analysis, Digital elevation and terrain model (DEM / DTM), buffer analysis and query analysis, Introduction to GPS and their applications with limitations, Applications of GIS in Environmental Engineering

**Reference Books**
3. Photogrammetry by – Sheford
Module 1

Module 2
Global Climatology - Global distribution of pressure and temperature at m.s.l. in winter and summer, distribution of annual rainfall and its variability, distribution of moisture and clouds. Vertical distribution of temperature. General circulation of atmosphere, Development of monsoons, Major categories of world climates

Module 3
Indian Climatology - Different seasons, Distribution of Means Sea level pressure/temperature in different seasons, Wind circulation and temperature distribution over India in lower, middle and upper troposphere in different seasons, Indian rainfall in different seasons, Indian summer monsoon, onset, withdrawal, rainfall distribution, inter annual variability of monsoon. Main synoptic pressure systems causing weather over India in different seasons

Module 4
Climate Change & Variability -Overview of the climatic history of the earth. Long term changes (Climate of Past century, past millennium, past glacial period), Methods of determining past climate. Possible causes of climate change- External (Milankovitch variation and Solar activity) and Internal (natural and anthropogenic ). General idea of internal dynamical processes of the atmosphere, oceanic processes, Cryospheric processes, land processes. Man's impact on climate, Greenhouse gases and global warming, basic radiation processes, Climate feedback mechanism, Climate predictability, future climate, potential consequences, International efforts to minimize climate change and their effects. Indian scenario

Reference Books
1. Atmosphere, Weather and Climate R.J. Barry and R.G. Chorley (Methuen Publication)
3. An Introduction to Meteorology by S. Pettersen
4. Elements of meteorology by Miller, Thompson and Paterson
5. General Meteorology by H.R. Byer
6. Monsoon by P.K. Das

Module 1:

Module 2:

Reference
1. As specified by the instructor

501 084 –G-  Elective –I  Foreign Language -I (French-I)  (1Credit Course)

Module 1:
Introduction: Glimpse of France, life of French people (Culture, food, etc.), French alphabets, accent, etc., Unit zero of the Text Book (Grammar, Vocabulary, and Lesson), Exercise of Unit zero of Text Book & workbook

Module 2:
French Lessons: Brief revision, Unit-1 of the Text Book (Grammar, vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 1 of the Text book & workbook

Reference
2. Jumelage-I workbook by Roopa Luktuke

501 084 –H--  Elective –I Engineering Ethics (1Credit Course)

Module 1:
Introduction: Meaning & scope of Ethics in general & for engineers in particular, Moral obligations and rules in engineering, Categories of moral, Work Culture, Corporate, local & global issues, Rights & responsibilities of Engineers, Conflicts in the profession, Mental Stresses & Emotional Intelligence

Module 2:
Code of Ethics for Engineers: First principles of Engineering Ethics & Ethical terminology, Social Values, Character, considerations for general Individuals, Engineers & the Society, Recommendations of the Professional bodies (Code of Conduct), Introduction to Copyright, IPR (Intellectual Property Right), Plagiarism & Legal issues

Reference

501 084 –I--  Elective –I Intellectual Property Rights  (1Credit Course)

Module 1
Introduction to Intellectual Property Rights

International Scenario
International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Module 2
Patent Rights

Recent Developments in IPR
Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies,
**Reference Books**

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**501 084 - J- Elective –I Sanskrit I (1Credit Course)**

**Module 1**
A) Brihatsamhita – Aadhyay 21: 1 to 15 sholkas
B) Brihatsamhita – Aadhyay 21:– 16 to 30 sholkas

**Module 2**
A) Brihatsamhita – Aadhyay 21:– 31 to 37 sholkas
   Aadhyay 22:– 1 to 7 sholkas
B) Brihatsamhita – Aadhyay 23: 1 to 9 shlokas

For the entire syllabus students have to prepare these subhashitmalas with their translation, explanation, reasoning behind the each sholka.

**Reference:**
Brihatsamhita by Varah Mihira

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**501 084 –K--Elective –I Mass communication, Photography and Videography**

(Audit Course—No Credits)

**Module 1: Mass Communication - Theories & methods**


**Module 2 : Photography and Videography**

Camera Basics, Still Photography, Lenses, Exposure, Composition, Colour. Shot Angle, Camera Movement, Light techniques and final printing.

Videography Basics – Video camera –types, mounting. Sound Basics, Film Sound appreciation, Sound Track analysis, Editing Basics, Fragmentation Juxtaposition: Frame, Shot, Sequence, Scene Time, Pace, Rhythm. Learning basic editing software and primary editing on available/given materials.

**Reference Books**

5. Holman, Tomlinson, Sound for film and television, Focal Press
Module 1

**Yoga:** Sukshma (subtle) yoga techniques, Difference between physical exercises and yogasans, Impact of yogasans on human body, benefits of yogasans, Patanjali yoga sutras, Technique of different yogasans like, Trikonasan, Ardha Chandrasan, Padmasan, Akarnadhanurasan, Ardhamatsendrasan, Vajrasan, Pachhimottanasan, Bhujangasan, Shalbhasan, Dhanurasan, Naukasan, Makrasan, Pawanmuktasan, Halasan, Sarvangasan, Shavasan, Suryanamaskar (Sun Salutation), Yoga and Food.

Module 2

**Meditation:** Breathing Technique, Pranayam, Benefits of Pranayam, Precautions for Pranayam, Kumbhak, Bandh (Locks), Chakras, Mudra, Technique of Pranayam, Anulom-Vilom Pranayam, Ujjayi Pranayam, Bhramari Pranayam, Bhastrika Pranayam, Aghnasar Pranayam, Kapalbhati Pranayam, Meditation (Dhyan).

**References Books:**

1. Light on Yoga: by B.K.S. Iyengar, Harper Collins Publishers India
2. Light on Pranayama: by B.K.S. Iyengar, Harper Collins Publishers India
3. Yoga for Dummies by Georg Feuerstein and larry Payne, Wiley India publishing
4. Yoga, Pilates, Meditation & Stress Relief By Parragon Books Ltd
5. The Yoga Sutras by Patanjali, Swami Satchidananda, Integral Yoga Publications
6. Meditation - Science and Practice by N. C. Panda, D. K. PrintworldPublisher
7. YogPravesh by Vishwas VMandlik, YogchaitanyaPrakashan
8. Asanand YogVigyan, Bhartiya YogSansthan, Delhi
9. PranayamVigyan, Bhartiya YogSansthan, Delhi

**Reference Web Sites:**


501 084 -- L.--Elective I  Yoga and Meditation (Audit course--Non Credit course)
UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER I
501 085 : Lab.Practice–I

Teaching Scheme
Lectures: 4 hours/week
Credits : 4

Examination Scheme
Term work : 50 Marks
Oral : 50 marks

Hydraulics and Environmental Laboratory – I

Lab Practice I

The lab, practice-I will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

The term work will consist of --

i) Visit reports of minimum two site visits, exploring the field aspects for various subjects

ii) Report on minimum 2 software applications on any subject of the semester.

iii) Report on at least one patent with its details studied in any subject of the semester.

iv) Report of laboratory work consisting of following:

1. Solution of Laplace equation by graphical / relaxation method.
2. Flow past a cylinder using wind tunnel.
3. Flow past aerofoil using wind tunnel.
4. Growth of a boundary layer along a flat plate using wind tunnel/air flow bench.
5. Determination of friction factor using experimental observations, Darcy-Weishbach equation and Moody’s diagram for different pipes (materials).
6. Assignment based on cost benefit studies of single and multipurpose projects– multi objective planning models, financial analysis of water resources projects.
7. Assignment on basin planning for water management.
8. Ambient air quality analysis for RSPM, PM 10, and analysis of automobile exhaust for CO, lead analysis.
10. Determination of cations, anions and any one heavy metal from water.
11. Sample collection methods and standardization of chemicals.
UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER II

501 086 : Environmental Hydraulics and Environmental Structures

Teaching Scheme
Lectures: 4 hours/week
Credits 4

Examination Scheme
In semester Exam: 50 Marks
End Sem. Exam. : 50 marks
Duration of end semester exam.: 3 hrs.

Module 1
Pumps, Compressor, Pipe size selection (including numericals, also):
Design of different type of pumps such as Reciprocating, Gear, Lobe, Vane, Centrifugal, Axial pump, Design of Centrifugal, Reciprocating, Axial compressor, Power calculation Selection of pipe size (diameter), pressure calculation, stress analysis, numerical on use of nomogram, laying a pipe line for residential area.

Module 2
Valves:
Study and applications of different types of valves such as pressure control valve, flow control valve, direction control valve, their applications, symbols used in hydraulic and pneumatic circuits. Problem on hydraulic and pneumatic circuit analysis,

Module 3
Actuators and Instrumentations
Study and applications of different types of actuators used in hydraulic and pneumatic circuits. Problem on design of actuator Instrumentations Level measurement, strain measurement, strain gauges, temperature measurement by RTD, Thermometer, Thyristor, Displacement and positioning sensor such as LVDT, RVDT, Tachometer, Doppler velocity meter.

Module 4
Different Operation in Process:

Module 5
Vibration and Seismic analysis for pipe and pipe support structure:
Single Degree of Freedom Systems - Free and Damped Vibrations, Fundamentals of Vibration: Elements of a vibratory system, S.H.M., degrees of freedom, modeling of a system, concept of linear and non-linear systems, equivalent spring, linear and torsional systems, Undamped free vibrations: Natural frequency by equilibrium and energy methods for longitudinal. Damped free vibrations: Different types of damping, equivalent viscous damping, free vibrations with viscous damping - over damped, critically damped and under damped systems, initial conditions, logarithmic decrement, dry
friction or coulomb damping - frequency and rate of decay of oscillations. Single Degree of Freedom Systems - Forced Vibrations in environmental structure.

Module 6  
**Design of Cylinders**

Cylinders: Thick and thin cylinders, thin cylindrical and spherical vessels, Lamé's equation, Clavarino's and Birnie's equations, design of hydraulic and pneumatic cylinders, auto-frettage and compound cylinders, gasketed joints in cylindrical vessels (No derivation),

Module 7  
**Pressure Vessels**

Modes of failures in pressure vessels, unfired pressure vessels, classification of pressure vessels as per I. S. 2825 - categories and types of welded joints, weld joint efficiency, stresses induced in pressure vessels, materials for pressure vessel, thickness of cylindrical shells and design of end closures as per code, nozzles and openings in pressure vessels, reinforcement of openings in shell and end closures - area compensation method, types of vessel supports (theoretical treatment only).

Module 8  
**Design of RCC Structure**

Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clarifloculators, aeration tanks etc. - effect of earth pressure and uplift considerations - selection of materials of construction. Design of concrete roofing systems - a) Cylindrical b) Spherical and c) Conical shapes using membrane theory of various types of folded plates & shell for roofing with concrete, IS Codes for the design of water retaining structures. Design of circular, rectangular and spherical type of RCC tanks.

**Reference Books**

2. Structure Dynamic -Mario Paz CBS Publication
3. Unit Operation by G.K. Ghavane
5. Water and Wastewater Engineering-Vol. II Fair, Geyer & Okun Wiley Toppan
6. Design of RCC Structure by Duggal
7. Mechanical Vibrations- Grover G. K., Nem Chand and Bros., Roorkee
8. Theory of Vibration with Applications- Thomson, W. T., CBS Publishers and Distributors

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**UNIVERSITY OF PUNE**  
**M.E. (CIVIL) (Water Resource and Environmental Engineering)**  
**SEMESTER II**

**501 087: Hydrology**

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
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<tbody>
<tr>
<td>Lectures: 4 hours/week</td>
<td>In semester Exam: 50 Marks</td>
</tr>
<tr>
<td>Credits 4</td>
<td>End Sem. Exam. : 50 marks</td>
</tr>
<tr>
<td></td>
<td>Duration of end semester exam.: 3 hrs.</td>
</tr>
</tbody>
</table>

**Module 1**

**Introduction:**

Hydrologic Cycle, Precipitation, Evaporation, Infiltration, Interception and Depression, Depth area duration analysis, Unit hydrograph theory, IUH, Rainfall runoff models-SWM, Tanks, CLS models
Module 2
Flow Generation:
Stochastic processes-classification, time series & its components, various statistical distributions like binomial, normal, log-normal, Poisson, Beta B, gamma, Pearson type I, II and III & their uses in hydrology, Chi square test, plotting, position, frequency factors, extreme value theory, synthetic generation of yearly and monthly flows in hydrology.

Module 3 Frequency analysis of hydrologic events
Frequency analysis, Frequency distribution models
Flood estimation by various methods, forecasting of floods, flood frequency analysis, Gumbel’s, Pearson type I, II, and III distribution, Log-normal method, design flood for various hydraulic structures

Module 4
Reservoir flood routing
Inflow outflow relationship, Different methods of flood routing such as Goodrich method, Modified Pul’s method

Module 5 Groundwater Hydraulics:
Definition of Ground Water, aquifers, vertical distribution of subsurface water, Darcy’s Law—it’s range of validity, Dupuit Forchheimer assumption, application of Darcy’s law to simple flow systems governing differential equation for confined and unconfined aquifers, fully & partially penetrating wells, interference of wells, pumping test with steady & unsteady flow, method of image.

Module 6 Groundwater Development:
Ground water Exploration, well types, well construction & design, screens, perforations & gravel packs, pumping equipment, quality of ground water, pollution of ground water

Module 7 Groundwater Conservation:
Ground water budget, seepage from surface water artificial recharge

Module 8 Ground water modelling techniques
Porous media models, Analog models, Electric analog models, Digital computer models

Reference Book
4. Elementry Engineering Hydrology—M.J.Deodhar--- Pierson Edution

UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER II

501 088 : Open Channel Hydraulics

Teaching Scheme
Lectures: 4 hours/week
Credits  4

Examination Scheme
In semester Exam: 50 Marks
End Sem. Exam. : 50 marks
Duration of end semester exam.: 3 hrs.
Module 1
Uniform flow—Review and revision of uniform flow formulae and design of channels, Uniform flow,
Flow through prismatic channels, efficient sections

Module 2
Non uniform gradually varied flow—Applications of continuity, momentum and energy equations,
Clcification of GVF profiles, Coputations for prismatic channels.

Module 3
Non uniform rapidly varied flow--Hydraulic Jump:
Formations of jump in expanding and contracting channel, jump type, jump control, jump on sloping
floors, sluice gate and free overfall flow, Convergence flumes

Module 4
Gradually Varied Steady Flow:
Gradually varied steady flow and rapidly varied steady flow in open channels, surface profiles in GVF-
analysis, different method of computations, Chow’s methods, standard step method, and finite
difference method.

Module 5
Spatially Varied Flow:
Differential Equation of spatially varied flow, profile computation,SVF with lateral inflow,SVF with
lateral outflow

Module 6
Unsteady Flow:
Gradually varied unsteady flow: Continuity equation, dynamic equation, Monoclinal rising waves,
dynamic equation for uniformly progressive flow, wave profile of uniformly progressive flow, wave
propagation, Rapidly varied unsteady flow: Uniformly progressive flow, positive surge, negative surge,
dam break problem

Module 7
Flow in mobile boundary channels
Initiation of motion, bed forms, channel resistance, sediment load, design of channels.

Module 8
Flood Routing:
Hydraulic and Hydrologic flood routing, Reservoir and channel routing, Differential form of
Momentum Equation, Muskinghum method, Finite difference scheme, Method of characteristics.

Reference Books
1. Open Channel Hydraulics – Ven Te Chow, Mc-Graw Hill.
4. Flow through open channels—Rajesh Srivastava—Oxford University Press
5. Open Channel Hydraulics-French, Mc-Graw Hill.

501 089 : ELECTIVE –II
Teaching Scheme Examination Scheme
Lectures: 5 hours/week In semester Exam: 50 marks
Credits 5 End Sem. Exam. : 50 marks
Duration of End Sem.Exam:3Hrs
Select any combination having total of 5 credits from following technical / interdisciplinary courses

<table>
<thead>
<tr>
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<th>Audit Course</th>
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22/44
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<th>Course Name</th>
<th>1 Credit Course</th>
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<tr>
<td>501089 A</td>
<td>Human Rights</td>
<td>501089 E Foreign Language II</td>
<td>501089 I Performing Arts – Music and Dance</td>
</tr>
<tr>
<td>501089 B</td>
<td>Mechanics of Waves</td>
<td>501089 F Industrial Safety</td>
<td>501089 J Principle Centred Leadership</td>
</tr>
<tr>
<td>501089 C</td>
<td>Water Management</td>
<td>501089 G Noise Pollution and Control Techniques</td>
<td></td>
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<tr>
<td>501089 D</td>
<td>Environmental Geotechnology</td>
<td>501089 H Sanskrit II</td>
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</tr>
</tbody>
</table>

**501 089 - A-Elective II Human Rights  (2 Credits course)**

**Module 1:**
*Human Rights – Concept, Development, Evolution*
- Philosophical, Sociological and Political debates
- Benchmarks of Human Rights Movement.
*Human Rights and the Indian Constitution*
- Constitutional framework
- Fundamental Rights & Duties
- Directive Principles of State Policy
- Welfare State & Welfare Schemes

**Module 2:**
*Human Rights & State Mechanisms*
- Police & Human Rights
- Judiciary & Human Rights
- Prisons & Human Rights
- National and State Human Rights Commissions

**Module 3:**
*Human Rights of the Different Sections* and contemporary issues
- Unorganized Sector ,
- Right to Environment, particularly Industrial sectors of Civil Engineering and Mechanical Engineering .
-Globalization and Human Rights
- Right to Development,

**Module 4. :**
*Citizens’ Role and Civil Society*
- Social Movements and Non-Governmental Organizations
- Public Interest Litigation
-Role of Non Government organizations in implementation of Human rights.
- Right to Information

**Human Rights and the international scene** – Primary Information with reference to Engineering Industry. (2 hrs)
- UN Documents
- International Mechanisms (UN & Regional)
- International Criminal Court

**References:**
1. Study material on UNESCO, UNICEF web site
3. Introduction to International Humanitarian Law by Curtis F. J. Doebbler - CD Publishing

**Internal assessment:**
i) Assignments based on topics from syllabus and case studies as applicable to relevant discipline of Engineering.
ii) Power point and oral presentation based on selected topic from syllabus.

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**501 089 –B-- Elective –II Mechanics of Waves (2 Credit Course)**

**Module 1**

**Module 2:**
Wave Theories
Basic hydrodynamic equations, wave theories - Linear wave theory, Finite amplitude wave theories (introduction only, no mathematical treatment): Stokes, wave theory, Cnoidal wave theory, Solitary wave theory, Dean stream function theory, Trochoidal wave theory, Non-linear versus linear wave theory, Choice of wave theory

**Module 3: Random waves**

**Module 4: Wave propagation**
Wave shoaling, wave refraction, wave diffraction, wave reflection, combined effects using numerical solutions, wave breaking, wave set up and set down, wave runup

**Reference Books**
501 089 –C-- Elective –II Water Management (2Credit Course)

Module 1
Introduction:
Global and national water problems, law and legislation, Indian Government Policies and Programs, Quantity estimation of water –urban and rural sectors’ requirement

Water Laws: Constitutional provisions, National Water Policy, riparian rights / ground water ownership, prior appropriation, permit systems, acquisition and use of rights, scope for privatization.

Module 2
Economics of water:
Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project.

Module 3
Watershed management:
Objectives of Planning Watershed Projects, Guidelines for Project Preparation, Approach in Govt. programmes, people’s participation, conservation farming, Watershed management planning, identification of problems, objectives and priorities, socioeconomic survey

Module 4
Flood management:
causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics,
Drought management: types of droughts, severity index, drought forecasting, damage assessment, mitigation plan, use of geoinformatics.

Reference Books

501 089 –D-Elective –II Environmental Geotechnology (2Credit Course)

Module 1
Soil classification, Identification and classification, criteria for classifying soil - classification on the basis of grain size, plasticity, symbolic & graphic presentation, Classified soils and engineering properties, Soil structure & clay minerals Clay minerals, clay water relations, clay particle interaction, soil structure & fabric, granular soil fabric. (Including numerical)

Module 2 Introduction to Environmental Geotechniques:
Environmental cycles and their interaction-Soil water environment interaction relating to geotechnical problems-Effect of pollution on soil water behavior. Sources, production and classification of wastes-
Environmental regulations in India-Case studies of foundation failures by ground contamination, (Including numerical)

**Site Selection And Method of Disposals:** Criteria for selection of sites for waste disposal facilities-parameters controlling the selection of wastes disposal sites-current practices for waste disposal, subsurface disposal techniques-Passive contaminant systems-Leachate contamination-applications of geomembrane and other techniques in solid and liquid waste disposal-rigid or flexible membrane liners. (Including numerical)

**Module 3 Hydrology of Contaminants:**
Transport phenomena in saturated and partially saturated porous media-contaminant migration and contaminant hydrology-Hydrological design for ground water pollution control-Ground water pollution downstream for landfills, bearing capacity of compacted fills-foundation for waste fill ground-pollution of aquifers by mining and liquid wastes-protection of aquifers (Including numerical)

**Module 4 Remedial Measures:**
Ground modification techniques in waste fill, Remedial measures for contaminated grounds-Remediation technology-Bio-remediation

**References Books**
3. Proceedings of the International symposium of Environmental Geotechnology

---

**501 089 –E--Elective II --Foreign Language –II French-II (1 Credit course)**

**Module 1**
French Grammar and Vocabulary: Unit-1, Lesson 2 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 1 of the Text Book, Exercise of Unit-1, Lesson 2 of the Text Book & workbook

**Module 2**
Advance Vocabulary, Writing & Speaking: Unit-1, Lesson 3 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 3 of the Text Book, Exercise of Unit-1, Lesson 3 of the Text Book & workbook, Revision & speaking practice

**Reference**
2. Jumelage-I workbook by Roopa Luktuke

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**501 089 –F--Elective II Industrial Safety (1 Credit course)**

**Module 1:**
Safety Management
Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

**Accident Investigation And Reporting**

Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports- Class exercise with case study.

**Module 2 : Safety Performance Monitoring**

Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

**Safety Education and Training**


**References**


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**501 089 –G--Elective II Noise Pollution And Control Techniques**

*(1 Credit course)*

**Module 1**

Introduction, Noise pollution, Nature of noise, Characteristics of noise, NEI, Sound pressure level and propagation of noise, Source of noise, Types of sources of noise, (mobile and non mobile) comparison of noise and Air pollution standards, Assessment and measurement of sound control facilities, Monitoring procedures (Including numerical)

Effects of noise on people and various protective equipments Like earplugs, earmuffs, etc. Basic principles of noise control, general noise control factors sources of vibrations.

Noise in Home & its control, control of Existing noise outside the home, Noise from construction and Civil Engineering works and its control, Noise from industry and its control (Including numerical)

**Module 2**

Road traffic noise and its control subjective rating of Automotive vehicles noise Characteristics of vehicle guidelines for vehicular noise, relation between noise and engine combustion system Aircraft and Airport noise. (Including numerical)

Legal Aspects of noise pollution, prediction and Assessment of Impacts on the noise Environment due to stationery and mobile noise sources, Existing legal provisions for controlling noise, International noise level standards. (Including numerical)

**Reference**

1) Noise Pollution - P. R. Trivedi, Gurdeep Raj
2) Environmental Noise Pollution and its Controls - G. R. Chatwal, M. C.
Mehra, M. Satake

501 089 –H--Elective II Sanskrit- II  (1 Credit course)

Module 1
A) Brihatsamhita – aadhyay 53: 1 to 20 shlokas
B) Brihatsamhita – aadhyay 53:– 21 to 40 shlokas

Module 2
A) Brihatsamhita – aadhyay 53:– 40 to 60shlokas
B) Brihatsamhita – aadhyay 53: 61 to 80 shlokas

For the entire syllabus students have to prepare these subhashitmalas with their translation, explanation, reasoning behind the each sholka.

References:
Brihatsamhita by Varah Mihira

501 089 –I--Elective II Performing Arts – Music and Dance
(Audit course--Non Credit course)

Module 1 :
Indian Music
Experiencing ethos and bliss by listening to performances of various reputed artists. Experiencing oneness with nature and the super power by performing individually or in a group.

Module 2 :
Indian Classical Dance
Types –Kathak, Bharatnatyam, Kuchipudi, Odissi etc. Importance of “Abhinaya” (acting) in dance. Role of “Taala” and “Laya” in dance. Various dance form. Various gharanas in traditional dance types Fusion with other dance styles. Experiencing the Indian cultural power through individual and group performances.

Books /Audio CD
5. Anup Rag Vilas by Pt.Kumar Gandharava, Bandishes composed and sung by author mostly available on cassettes Swarganga Foundation.
7. Introduction to Bharata’s Natyashastra by Adya Rangacharya, Munshiram Manoharlal publication.
8. Art of Dancing classing and folk dance by priyabala Shah, Parimal publication

501 089 –J--Elective II Principle Centered Leadership
(Audit course--Non Credit course)

Module 1:
Motivation, Leadership and Competency
a) Motivation:--

b) Competency Mapping:--

Module 2:
Entrepreneurship and strategic Management

   b) Strategic Management: --

Reference Books
1. Seven habits of highly effective people—Stephen Covey—Franklin Covey Publications
2. Living the seven habits Stephen Covey—Franklin Covey Publications
3. 8th Habit – from effectiveness to greatness Stephen Covey—Franklin Covey Publications
5. Human Resources Management & Human Relations , V P Michael , Himalaya
7. Construction project Management, integrated approach—Feedings First Indian Reprint 2011—Yesdee publications
8. Cases in Strategic Management, Amita Mital , Tata Mcgraw Hil

UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER II

501 090 -Lab.Practice–II

Teaching Scheme
Lectures: 4 hours/week
Credits : 4

Examination Scheme
Term work : 50 Marks
Oral : 50 marks

Lab Practice II
The lab. practice-II will be based on completion of assignments / practicals / reports of site visits, confined to the courses in that semester.
The term work will consist of --
   i) Visit reports of minimum two site visits, exploring the field aspects for various subjects
   ii) Report on atleast one patent with its details studied in any subject of the semester.
   iii) Technical review and critique of a research article/paper from journal on atleast one topic
   iv)The laboratory work report of following experiments.....

1. Characteristics of Hydraulic Jump in horizontal and sloping channel
2. Velocity distribution in open channel flow using pitot tube or current meter
3. Assignment on open channel flow simulation software such as HEC RAS /MIKE-21
4. Numerical simulation of 1-D open channel flow using MATLAB
5. Assignment on flood forecasting
6. Assignment on ground water hydrology
7. Determination of DO, BOD and COD from Waste Water
8. Determination of organic nitrogen (NH₃)
9. Determination of heavy metal from Waste Water (any heavy metal)
10.Determination of phosphate and nitrate

UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER II
501 091-Seminar – I

Teaching Scheme
Pract. 4 hrs./week

Examination Scheme
Oral : 50 Marks,
TW :: 50 Marks
Credits 4

Term work of the seminar should consist of spiral bound report printed on both the sides of pages on any technical topic of interest associated with the post graduate course and should be submitted in a standard format having the following contents.
   i. Introduction
   ii. Literature Survey
   iii. Theoretical contents
   iv. Relevance to the present national and global scenario of construction industry
v. Strengths and weaknesses of the particular area of seminar
vi. R & D in the particular area
vii. Field Applications / case studies / Experimental work / software application / Benefit cost studies – feasibility studies
viii. Vendors associated
ix. Conclusions
x. References

Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

It is desired that based on the seminar work, a paper be prepared and presented in a state / national conference.

At the end of first year, the students are required to undergo through a field training of minimum 2 weeks duration. The presentation and separate report of the vocational training will be submitted along with report of seminar II.
UNIVERSITY OF PUNE  
M.E. (CIVIL) (Water Resource and Environmental Engineering)  
SEMESTER III  

601 092: Advanced Water and Waste Water Treatment

Teaching Scheme
Lectures: 4 hours/week
Credits 4

Examination Scheme
In semester Exam: 50 Marks
End Sem. Exam.: 50 marks
Duration of end semester exam.: 3 hrs.

Module 1
Objectives of advanced water and waste water treatment
Water and wastewater characteristic such as physical, chemical and biological, use of peak factor, flowcharts, function and basic principles involved in different units water and wastewater treatment. Standards for drinking water as per IS: 10500 and waste water. Primary, secondary and tertiary treatment process in water and waste water, Design of tertiary treatment process such as membrane process, electro dialysis, ion exchange, reverse osmosis, U.F. for water and waste water.

Module 2
Water Treatment Unit Design
Type intake structure such as river, canal intake structure, Design of pump house, Aeration: Principle and concept, necessity, method of removal of test and odour, Design of fountain, tray type aerator, Sedimentation: Sedimentation tank principle, Design of plain sedimentation tank, design of tube settler. Coagulation and flocculation: Theory, common coagulant aids like bentonite clay, lime stone, silicate and polyelectrolyte’s, mean velocity gradient “G” and power consumption, design of flocculation chamber, design of clariflocculator. Design of Gear box for flocculation: Calculation of velocity, gear reduction ratio, power consumption, number of teeth on gear and spur gear, different type of gear use and their application. Water distribution system: continuous and intermittent, calculation of balancing capacity of reservoir by mass flow curve and graphical method. (only design part)

Module 3:
Unit Operation in Water Treatment Process
Theory of filtration, mechanism of filtration, material use, types of filters such as slow sand filter, rapid sand filter and pressure filter. Filter media single, dual head loss calculation in filtration by using Rose Equation (Problem on Rose Equation), Components, under draining system, cleaning and operational trouble in filtration, Disinfection: Theory, factor affecting disinfection, types and method of chlorination, break point chlorination, bleaching power estimation. Water softening method: lime soda, zeolite and ion exchange Demineralization method like R.O, Electro dialysis and ion exchange Introduction to membrane process and design of membrane process. Theory of corrosion and corrosion control in piping (Including numerical)

Module 4
Waste Water Treatment Unit Design
Sewage quantity, Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Design of circular sanitary sewers. Sewer materials, choice of materials, testing of sewer pipes, sewer appurtenances, Pumping of sewage and types of pumps, Introduction and relationship between TOC, COD and BOD. Effect of change of life on sewage quality, Sewage treatment: Process flow diagram for sewage treatment, Theory and design off-screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO. (Including numerical)
Module 5

Module 6
Trickling filter
Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures.

Module 7
Theory & design of anaerobic treatment units

Module 8
Industrial waste water treatment
Methods of sampling. Equalization and neutralization, Application of preliminary, primary and secondary treatment for industrial wastewater as per the pollution control norms. Sources of waste water from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries: Sugar, dairy, distillery, paper & pulp and textile, Flowchart and automobile industry, discharge standards as per pollution control norms. (Including numerical)

Reference
3. Wastewater Treatment and disposal, By S.J. Arceivalla, Marcel Dekker, 1981.
6. Water Supply Engg by Dr. B.C.Punmia ,Laxmi Publicaiton
UNIVERSITY OF PUNE  
M.E. (CIVIL) (Water Resource and Environmental Engineering)  
SEMESTER III  

601 093-Dam Engineering

<table>
<thead>
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<tr>
<td>Lectures: 4 hours/week</td>
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<tr>
<td>Credits 4</td>
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<tr>
<td></td>
<td>Duration of end semester exam.: 3 hrs.</td>
</tr>
</tbody>
</table>

Module 1  
Gravity Dams:  
Forces acting on the gravity dams earthquake force-pseudostatics and dynamic response approach, load classifications, stability analysis, distribution of shear and normal stresses, principle stresses, Stress concentration around openings, foundation treatments, Design of concrete dam. Reservoir operation

Module 2  
Earthen Dams:  
Seepage through dam and its foundations, stability analysis for sudden drawdown condition, steady seepage condition, end of constructions, seismic effects, pore pressures, protection of upstream and downstream slopes.

Module 3  
Arch Dams  
Arch dams-General concepts of trail load theory, elastic shell methods, thick cylinder theory

Module 4  
Buttress Dam and Rock fill Dams:  
Relevant rock fill characteristics, general design principal method of construction and compaction. Buttress dam- Concepts and Design

Module 5  
Spillways-  
Spillway-types, components, design principles, Design of different spillways such as Ogee, side channel, siphon. Energy dissipation devices and their design

Module 6  
Dam Safety and Instrumentation:  
Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles of instruments, Selection of Equipments, Different Instruments----
    Piezometers, Porous tube piezometer (Determination of uplift pressure), Pneumatic piezometer (Determination of ground water pressure), Vibrating wire piezometer (Determination of pore water pressure), Settlement measurement system, Vibrating wire settlement cell (Determination of settlement of earth dam embankments), Magnetic settlement system (Determination of settlement and lateral movements), Inclinometer (Determination of shear plane and lateral movements), Jointmeter (Determination of movement of joints), Pendulums (Determination of tilt and rotation), Vibrating wire pressure cell (Determination of total pressure and stress distribution), Seismograph (Determination of earthquake shaking
Module 7
Different organizations worldwide such as ICOLD, ICID, GWP, CWC, and their functioning.

Module 8
Dams – Social issues, Displacement and rehabilitation, social impact assessment, environmental impact assessment, dams and climate change.

Reference Books
1. Concrete Dams – R.S. Varshney
2. Irrigation Water Resources & Water Power Engineering P.N. Modi
3. Earth Dams – J.L. Sherard
4. Water resources Engineering Principles and Practice- S. Murty Challa- New Age International

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UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER III

601 094- Elective –III

Teaching Scheme
Lectures: 5 hours/week
Credits 5

Examination Scheme
In semester Exam: 50 marks
End Sem. Exam. : 50 marks
Duration of End Sem. Exam: 3 Hrs

Select any combination having total of 5 credits from following technical / interdisciplinary courses ---

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<th>Code</th>
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<td>601 094C</td>
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35/44
601 094-A-Elective III Optimization Techniques (2 Credit course)

Module 1
**Linear Programming:** Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method, Big M Method, Two phase method, Duality, sensitivity analysis. Application of Linear Programming to Hydraulics & Water Resource

Module 2
**Non Linear Programming:** Unconstrained one Dimensional search methods: Dichotomous search method, Fibonacci, Golden section, Multivariable unconstrained techniques: Steepest ascent and Descent methods, Newton’s methods, Constrained technique: Lagrangian Multiplier

Module 3
**Dynamic Programming and Stochastic Methods:**
Principle of optimality, recursive equations, Queuing theory, simulation technique, sequencing model

Module 4
**Games Theory:**
Theory of games, 2 person zero sum game with and without saddle point, mixed strategies (2 x n games or m x 2 games), 2 x 3 game with no dominance, graphical method

Reference
2. Operation Research – Taha Hamdey A.
4. Operation Research – Hira and Gupta, S.Chand

601 094-B-Elective III Ground Water Modelling (2 Credit course)

Module 1 **Groundwater Occurrence & Movement:**
General Introduction, Darcy’s law, application of Darcy’s law to confined and unconfined aquifers, wells - fully & partially penetrating wells, multiple wells, interference of wells, pumping test with steady and unsteady flow

**Surface and sub-surface investigation of ground water:** Geological/geophysical exploration/remote sensing/electric resistivity/seismic refraction based methods for surface investigation of ground water, test drilling and ground water level measurement
Sub-surface ground water investigation through geophysical/resistivity/spontaneous potential/radiation/temperature/calliper/fluid conductivity/fluid velocity/miscellaneous logging. (Including numerical)

Module 2
**Planning of groundwater development:**
Water balance, assessment of recharge, utilisable recharge, Groundwater estimation norms in India, Constraints on groundwater development. Planning of ground water development in canal command areas-conjunctive use models, planning of ground water development in coastal aquifers

Module 3
**Numerical modelling of groundwater flow:**
Ground water modelling through porous media/analog/electric analog/digital computer models; Review of differential equations, finite difference solution, direct problem, inverse problem; groundwater modelling using finite element method
Artificial ground water recharge: Concept, methods of artificial ground water recharge, waste water recharge for reuse, water spreading

**Module 4 – Management of Ground Water:**
Ground water basin management concept, hydrologic equilibrium equation, ground water basin investigations, data collection & field work, dynamic equilibrium in natural aquifers, management potential & safe yield of aquifer, stream-aquifer interaction.

**Saline water intrusion in coastal aquifers:** Ghyben-Herzberg relation between fresh & saline waters, shape & structure of fresh & saline water interface
Upcoming of saline water, fresh-saline water relations on oceanic islands, sea water intrusion in Karst terrains, saline water intrusion control

**Reference**

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**601 094—C-Elective III Solid and Hazardous Waste Management**
(2 Credit course)

**Module 1**
**Solid waste management:**
Objectives, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, Types, Composition, Quantities, Physical, Chemical and Biological properties.

**Solid waste generation rate:** Definition, Typical values for Indian cities, Factors affecting. Storage and collection: General considerations for waste storage at source, Types of collection systems.

**Module 2**
**Sorting and material recovery:**


**Landfills:** Definition, Essential components, Site selection, Land filling methods, Leachate and landfill gas management.

**Indian scenario:** Present scenario and measures to improve system for different functional elements of solid waste management system. Elements of financial management plan for solid waste system. (Including numerical)

**Module 3**
**Legal and Organizational foundation:**
Definition of solid waste - waste generation in a technological society - major legislation, monitoring responsibilities, sources and types of solid waste - sampling and characterization

Module 4
Hazardous waste treatment technologies
Design and operation of facilities for physical, chemical and thermal treatment of hazardous waste - Solidification, chemical fixation and encapsulation, incineration, Hazardous waste landfills: Site selection, design and operation- remediation of hazardous waste disposal sites. Sampling and characterization of Solid Wastes; TCLP tests and leachate studies

Reference Books
2. Integrated solid waste management – George Tchobanoglous, Mcgraw Hill
3. Solid waste management handbook– Pavoni

601 094-D-Elective III Industrial Waste Management (2 Credit course)

Module 1
Use of water in industry, sources of wastewater, quality and quantity variations in waste discharge, water budgeting, characterization and monitoring of wastewater flow, stream standards and effluent standards as per CPHEEO
Waste volume and strength reduction, in-plant measure, good housekeeping, process change, leakage prevention, segregation and recycling Neutralization, equalization and proportioning of waste (Including numerical)

Module 2
Water Quality monitoring of Streams, Self purification of streams, B.O.D. reaction rate, D.O. sag curve and D.O. deficit calculations
Miscellaneous methods of dissolved solids removal, sludge disposal methods
Different types of waste treatment & their selections, Development of treatment flow diagram based on characteristics of waste
Manufacturing processes in major industries, water requirements, wastewater sources, composition of wastes, Viz. sugar, distillery, dairy, pulps, paper mill, fertilizer, tannery, chemical, steel industry, alternative methods of treatment, factors affecting efficiency of treatment plant (Including numerical)

Module 3
Acclimatization of bacteria to toxic wastes, process sensitivity, operation and maintenance requirements, Water pollution control act, organizational set up of central and state boards for water pollution control, classification of river on water use, minimal national standards, socio-economic aspects of water pollution control, Introduction to Membrane Processes, Membranes and Modules: Principles of Membrane processes; Types and uses of membranes; Recent development in membranes; Types and uses of modules; Washing procedures. Applications of Membrane Processes in Environmental Engineering: Membrane bioreactors; Prevaporation and its applications; Reverse Osmosis, Ultra filtration and Microfiltration and their applications; Dialysis and Electro dialysis and their applications. (Including numerical)

Module 4
Modern Trends in Environmental Engineering, Cleaner Production Technologies, Environmental Bio-
Technology, Bioremediation, Risk Analysis, Software and Information Systems, Global Issues,
Environmental pollution monitoring sensors- Basic understanding of the interaction of electromagnetic
radiation, sound, laser etc. with matter, Familiarization with a variety of sensors and platforms
Anthropogenic Endocrine Disruption, The Scientific Basis of the Endocrine Hypothesis

Reference Books
2 Industrial Waste Treatment, Nelson Maneroo
3 Industrial Waste Treatment, Rao & Datta
4 R. Rautanbach and R.Albrecht, Membrane Process, John Wiley & Sons
5 R.Y.M. Huang, Perevoparation Membrane Separation Processes, Elsevier.
6 J.G. Crespo, K.W. Boddekes, Membrane Processes in Separation and Purification, Kluwer

601 094 –E-Elective III  Project Proposal writing and funding (1 Credit course)

Module 1
Introduction to grants and their place in the development of organizations, planning skills needed for
strong proposals. Components of an application, Helpful tools and resources, Strategies for developing
a proposal, How to identify potential funding sources, How to read and understand proposal guidelines
and requests for proposals (RFP), Writing objectives, Preparation and justification of budgets ,Protocols
for use of animal and human subjects in research, Cost sharing and sub-contracts, Procedures for grants
submission and grants start up, The grant review process, Writing cover letters, Preparing a curriculum
vitae.

Module 2
Study a proposal or a dummy proposal written for sanctioning of grant for BCUD,AICTE etc.
Develop and submit a draft a proposal for a grant sanctioning authority (related to a particular project)
with the following main points:
a. Identify a fundable topic, based on a need or a problem you’ve identified
b. Identify a potential funder
c. Obtain their program description and application forms
d. Develop a draft proposal that meets the funder’s requirements.
The proposal may include:
1. Problem statement
2. Research design / work plan
3. Time line
4. Budget
5. Project personnel
6. Other supporting documents

Reference: As specified by the instructor
601 094-F-Elective III Foreign Language French-III (1 Credit course)

**Module 1: French Grammar and Vocabulary:** Unit-1, Lesson 4 of the Text Book (Grammar & Vocabulary), Unit-1, Lesson 4 of the Text Book, Revision & speaking practice

**Module 2:** Advance Vocabulary, Writing & Speaking, Exercise of Unit-1, Lesson 4 of the Text Book & workbook, Practicing Simple conversation in French, Revision & practice of conversation (Simple questions & answers)

**Reference:** Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke
Jumelage-I workbook by Roopa Luktuke

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601 094 –G--Elective III Rural Engineering-I (1 Credit course)

**Module 1:**
- **Rural Development and Infrastructure development.**
  Introduction to rural engineering, elements of rural engineering, productivity, animal husbandry and agriculture, rural art and craft, Infrastructure development such as irrigation, communication, village betterment, transportation, education such as educational institute, Financial assistance from Z.P. and other sources.
  Human Resources and development, Health care center, rural sanitation, combined program for women and pre school children. Employment generation, integrated ruler development programme, landless employment guarantee program, present rural status, role of NGO and corporate sector.

**Module 2:**
- **Socio Economic Development**
  Rural population growth rate, rural literacy, manpower, cultivators, agriculture, industrial worker, manufacture worker, rural poverty. Five years plan for rural development.

**Govt. Policy and schemes for rural development.**
Various policies for rural development, various schemes such as micro finance and rural banking, integrated village development model, Swaranjayanti Gram Swarojgar Yojana, Samparan Grammen Rozgar Yojana, Micro finance and rural banking

**Reference:** As specified by the instructor

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601 094 –H-Elective III Chess (Audit Course---No Credit course)

**Module 1**
Introduction of chess game, What is chess board, the place of chess board, Chess pieces position & its moves, The concept of attacking, The concept check with different pieces, Mate/Checkmate, Castling, Pawn Promotion, Notation, Stalemate, Pointing

**Module 2**
End game, attacking a piece, Opening principles, Piece exchange, Pin, Defining the draws in Chess

**Reference:** As specified by the instructor
Module 1
Introduction of Abacus, addition & subtraction with help of small friends, big friends & big family, Concept of visualization, Multiplication & Division

Module 2
Additional & Subtraction with decimal concept, Determine cube root & square root

Reference: As specified by the instructor

UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER III

601 095 Seminar – II

Teaching Scheme
Pract. 4 hrs./week

Examination Scheme
Oral : 50 Marks,
TW :: 50 Marks
Credits 4

Term work should consist of ---

I) Spiral bound report preferably, printed on both the sides of paper on the topic of dissertation work and should be submitted in a standard format having the following contents.
   i) A report on training undergone on a construction project site/organization/for a period of minimum 15 days, including the data collection necessary for the project work.
   ii) A report on the topic of dissertation, containing the following:
       a) Literature review and problem statement formulation.
       b) Research Methodology and proposed schedule of completion of project work.

   Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.

II) Spiral bound report preferably, printed on both the sides of paper on vacational training of 2 weeks
The project work will start in semester III, and should preferably be a live problem in the industry or macro-issue having a bearing on performance of the construction industry and should involve scientific research, design, collection, and analysis of data, determining solutions and must preferably bring out the individuals contribution.

The dissertation stage I report should be presented in a standard format, in a spiral bound hard copy, preferably printed on both the sides of paper, containing the following contents.

i. Introduction including objectives, limitations of study.

ii. Literature Survey, background to the research.

iii. Problem statement and methodology of work

iv. Theoretical contents associated with topic of research

v. Field Applications, case studies

vi. Data collection from field/organizations or details of experimental work/analytical work

vii. Part analysis / inferences

viii. Details of remaining work to be completed during the project work stage II

ix. References

Students should prepare a power point presentation to be delivered in 25 minutes and should be able to answer questions asked in remaining five minutes. (It is preferred that at least one paper on the research area be presented in a conference or published in a referred journal.)
UNIVERSITY OF PUNE  
M.E. (CIVIL) (Water Resource and Environmental Engineering) 
SEMESTER IV

601 097 Seminar – III

Teaching Scheme
Pract. 5 hrs./week

Examination Scheme
TW : 50 Marks
Oral / Presentation-50 marks
Credits : -5

Term work should consist of a spiral bound report on the topic of dissertation work, preferably typed on both the sides of pages and should be submitted in a standard format.
Seminar III will be assessed based on the requirements of completion of project work for the project stage II.
Students should prepare a power point presentation to be delivered in 15 minutes and should be able to answer questions asked in remaining five minutes.
UNIVERSITY OF PUNE
M.E. (CIVIL) (Water Resource and Environmental Engineering)
SEMESTER IV

601 098-Project work Stage II

Teaching Scheme
Pract. 20 hrs./week

Examination Scheme
Oral/Presentation : 50 Marks
TW : 150 Marks
Credits : - 20

The final dissertation should be submitted in black bound hard copy preferably typed on both the sides of paper as well as a soft copy on CD.

(The due weight will be given for the paper(s) on topic of project presented in a conferences or published in referred journals.)
The Term Work of Dissertation of semester IV will be assessed jointly by the pair of internal and external examiners, along with oral examination of the same.