# 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**

| Code | Subject | Teaching Scheme | Examination scheme | | | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lect./ Practical | Paper | | TW | Oral /Presentation | Total | |
| | | | In Semester Assessment | End Semester Assessment | | | | |
| 501 081 | Planning and Management of Water Resources | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 501 082 | Environmental Chemistry and Microbiology | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 501 083 | Fluid Mechanics | 4 | 50 | 50 | -- | -- | 100 | 4 |
| **501 004** | Research Methodology Treatment | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 501 084 | Elective I | 5 | 50 | 50 | -- | -- | 100 | 5 |
| 501 085 | Lab Practice I | 4 | | | 50 | 50 | 100 | 4 |
| | **Total** | **25** | **250** | **250** | **50** | **50** | **600** | **25** |

**501 084-Elective I**

| Code | 2 Credits Course | Code | 1 Credit Course | Code | Audit Course (No Credit Course) |
|---|---|---|---|---|---|
| 501 084**A** | Cyber Security / Information Security | 501 084 **F** | Economics & Finance For Engineers | 501 084 **K** | Mass communication, Photography and Videography |
| 501 084 **B** | Computational Methods | 501 084 **G** | Foreign Language –I | 501 084**L** | Yoga and Meditation |
| 501 084 **C** | Energy and Environment | 501 084 **H** | Engineering Ethics | | |
| 501 084 **D** | Remote Sensing and Geographical Information System | 501 084 **I** | Intellectual Property Rights | | |
| 501 084**E** | Climate change | 501 084**J** | Sanskrit-I | | |

**SEMESTER –II**

| Code | Subject | Teaching Scheme | Examination scheme | | | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lect./ Practical | Paper | | TW | Oral/Presentation | Total | |
| | | | In Semester Assessment | End Semester Assessment | | | | |
| 501 086 | Environmental Hydraulics and Environmental Structures | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 501 087 | Hydrology | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 501 088 | Open Channel Hydraulics | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 501 | Elective II | 5 | 50 | 50 | -- | -- | 100 | 5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 089 | | | | | | | | |
| 501 090 | Lab Practice II | 4 | -- | -- | 50 | 50 | 100 | 4 |
| 501 091 | Seminar I | 4 | -- | -- | 50 | 50 | 100 | 4 |
| | **Total** | **25** | **200** | **200** | **100** | **100** | **600** | **25** |

**501 089 : ELECTIVE –II**

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

| **Code** | **2 Credits Course** *L* | **Code** | **1 Credit Course** | **Code** | **Audit Course (No Credit Course)** |
|---|---|---|---|---|---|
| 501089 **A** | Human Rights | 501 089 **E** | Foreign Language II | 501 089**I** | Performing Arts – Music and Dance |
| 501 089 **B** | Mechanics of Waves | 501 089 **F** | Industrial Safety | 501 089 **J** | Principle Centred Leadership |
| 501 089 **C** | Water Management | 501 089 **G** | Noise Pollution and Control Techniques | | |
| 501 089 **D** | Environmental Geotechnology | 501 089 **H** | Sanskrit II | | |

**SEMESTER –III**

| **Code** | **Subject** | **Teaching Scheme** | **Examination scheme** | | | | | **Credits** |
|---|---|---|---|---|---|---|---|---|
| | | **Lect./ Practical** | **Paper** | | **TW** | **Oral/Presentation** | **Total** | |
| | | | **In Semester Assessment** | **End Semester Assessment** | | | | |
| 601 092 | Advanced Water and Waste Water Treatment | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 601 093 | Dam Engineering | 4 | 50 | 50 | -- | -- | 100 | 4 |
| 601 094 | Elective III | 5 | 50 | 50 | -- | -- | 100 | 5 |
| 601 095 | Seminar II | 4 | -- | -- | 50 | 50 | 100 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 601 096 | Project Stage I | 8 | -- | -- | 50 | 50 | 100 | 8 |
| | **Total** | **25** | **150** | **150** | **100** | **100** | **500** | **25** |

**601 094 : ELECTIVE –III**

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

| **Code** | **2 Credits Course** *L* | **Code** | **1 Credit Course** | **Code** | **Audit Course (No Credit Course)** |
|---|---|---|---|---|---|
| 601 0094**A** | Optimization Techniques | 601 0094**E** | Project Funding | 601 0094**H** | Chess |
| 601 0094**B** | Ground Water Modelling | 601 0094**F** | Foreign Language-III | 601 0094**I** | Abacus |
| 601 0094**C** | Solid and Hazardous Waste Management | 601 0094**G** | . Rural Engineering | | |
| 601 0094**D** | Industrial Waste Management | | | | |

**SEMESTER –IV**

| **Code** | **Subject** | **Teaching Scheme** | **Examination scheme** | | | | | **Credits** |
|---|---|---|---|---|---|---|---|---|
| | | **Lect./ Practical** | **Paper** | | **TW** | **Oral /Presentation** | **Total** | |
| | | | **In Semester Assessment** | **End Semester Assessment** | | | | |
| 601 097 | Seminar III | 5 | -- | -- | 50 | 50 | 100 | 5 |
| 601 098 | Project Work Stage II | 20 | -- | --- | 150 | 50 | 200 | 20 |
| | **Total** | **25** | **---** | **--** | **200** | **100** | **300** | **25** |

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# M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER I**

**501 081- Planning and Management of Water Resources**

| | |
|---|---|
| **Teaching Scheme :** | **Examination Scheme:** |
| **Lectures :4 Hrs./Week** | **Theory Paper : 100 Marks** |
| **Credits : 4** | **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**


1. James, L .D., and Lee, R. R., "Economics of Water Resources Planning", Mc Graw Hill.
2. Principles of Water Resources planning-by Goodman.
3. Water Resources System Planning – by M.C. Chaturvedi.
4. Water Resources Planning and Management by-O.J. Helwege.
5. Water Management System Application-A.K. Biswas
6. Water resource Engineering- Linsley and Franzini, Mc Graw-Hill
7. Water resources planning and management- Grafton and Hussey, Cambridge Uni. Press.

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# 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 currant (wind rose digram) 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.**

Introduction to various physico-chemical parameters, their method of detection in water , waste water, solid waste and in soil. Water quality, Indian standards, quality control method. Various organic and inorganic compound such as surfactant, pesticides, synthetic polymers. Toxicity test on hazardous waste. Waste generation rate and energy recovery from SWM. Method for determination concentration of pollutant in air, liquid ,solid and hazardous waste. Chemical process calculations. Various method of determination of pollution 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 micro biology 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 aerobic 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

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## 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**


1. Fluid Mechanics and Hydraulic Machines – Sukumar Patil, Tata McGraw-Hill
2. Fluid Mechanics- Grade & Mirajgaonkar
3. Fluid Mechanics and Machinary- D. Ramadurgaiah, New age International
4. Boundary Layer Theory- H. Schlichting, Springer New-York 2000
5. Fluid Mechanics-Victor L Streeter & E.B. Wylie, Mc-Graw Hill
6. Fluid Mechanics-Frank M White, Mc-Graw Hill
7. Fluid Mechanics-Fundamentals and Applications- Cengel and Cimbala, McGraw-Hill


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## M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER I**

### 501 004 : Research Methodology

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 4 hours/week** | **In semester Exam: 50 Marks** |
| **Credits 4** | **End Sem. Exam. : 50 marks** |
| | **Duration of end semester theory paper: 3 hrs.** |

**Module1:**

**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 agaencies.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,qualititative 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.Valedity 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,Mutidimentional measurementnand factor analysis
**Module 7:**
**Report writing—**Need of effective documentation, importance of report writing, types of reports, report structure, report formulation,Plagirism.
**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:**

1. Research Methodology**:** concepts and cases—Deepak Chawla and Neena Sondhi,Vikas Publishing House Pvt.Ltd. (ISBN 978-81-259-5205-3)
2. Research Methods for Business—Sekaran Uma and Roger Bougie—Wiley,India
3. Research Methodology: Methods and Trends', by Dr. C. R. Kothari--- New Age International Publishers.
4. Research Methods in Education---Louis Cohen,Manion,Morrison---Routledge(Taylor &Francis Group) / -- Cambridge University Press India Pvt. Ltd.-ISBN-978-0-415-58336-7
5. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville
6. Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar
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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## M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER I**

**501 084 : Elective –I**

**Teaching Scheme**
**Lectures: 5 hours/week**
**Credits 5**

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

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

**501 084- Elective I**

| Code | 2 Credits Course<br>*L* | Code | 1 Credit Course | Code | Audit Course (No Credit Course) |
|---|---|---|---|---|---|
| **501 084 A** | Cyber Security/Information | **501 084 F** | Economics & Finance For Engineers | **501 084 K** | Mass communication, Photography |

| | | | | | |
|---|---|---|---|---|---|
| | security | | | | and Videography |
| **501 084 B** | Computational Methods | **501 084 G** | Foreign Language –I | **501 084 L** | Yoga and Meditation |
| **501 084 C** | Energy and Environment | **501 084 H** | Engineering Ethics | | |
| **501 084 D** | Remote Sensing and Geographical Information System | **501 084 I** | Intellectual Property Rights | | |
| **501 084 E** | Climate change | **501 084 J** | Sanskrit-I | | |

**501 084 AElective I - Cyber Security / Information security (2Credits course)**

**Module1:**

**Basic Concepts of Technology and Law***:* Basics of Information Technology, Basics of Indian Legal System, Information Technology Act 2000 (Amended), Relevant Amendments in all other laws.E-Contract**:** The essence of digital contracts, Law of Contract, Construction of E-contracts, Issues of security, Employment contracts, Consultant Agreements and Digital signature

**Module2:**

**Intelligent Property Issues in Cyber space:** Doman 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:**

**Information Security Fundamentals:** Background, Importance, Statistics, National and International Scenario, Goals of security, Confidentiality, Privacy, Integrity, Non-repudiation, Availability.

Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis - Vulnerability identification and Assessment.

**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

**Security Policies and Management:** Security Policy Design, Designing Security Procedures, Risk Management and Assessment Techniques, Security standards, Security Models. Security Management Practices, Security Laws, Information Classification Process, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance,

**Reference Books:**

1) Bakshi P M and Sri R K, Cyber and E-commerce Laws, Bharat Publishing House, 1st Edn, 2002

2) Syed Shakil Ahmed, Rajiv Raheja, A handbook on Information technology: Cyber law and E-Commerce, Capital Law House, 2004
3) Rodney D Ryder, Business Process Outsourcing, Date Protection and Information Security, Wadhwa & Co., 1st Edn, 2001
4) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn, 2011
5) Lipton, K., Cyberspace Law Cases and Materials, 2nd edition. Aspen Publishers. NY: New York, 2006
6) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
7) Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
8) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003

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

**Module1:**

**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**

1.Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
2.Venkatraman, M.K., Numerical Methods in Science and Engineering, National Publisher Company.
3.Numerical Methods by Krishna Raju
4.Shanthakumar M.S., Numerical Methods & Analysis
5.Gupta, S.C. and Kapur, V.K., "Fundamentals of Mathematical Statistics ", Sultan Chand & Sons, New Delhi, 1999.

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## 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**:

Electromagnetic energy, Interaction of EMR with Atmosphere and earth material, atmospheric windows, EMR spectrum, platform, sensor types, MSS. Aerial Remote Sensing:- Flight planning, types of Aerial photographs,. Photogrammetry: stereoscopic vision, scale, relief displacement, parallax, vertical exaggeration.

**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**

1. Remote sensing methods & applications – R. Michael Hord, Wily Interscience Publication.
2. Remote sensing & image interpretation – Lilleson J.T.M. & Krefer R.W. Wiely, New York.
3. Photogrammetry by – Sheford

4. Remote sensing in Civil Engineering – J.M. Kennie & M.C. Mathews.

## 501 084 – E -Elective I- Climate Change (2Credits course)

**Module 1**

Atmosphere and its constituents, Synoptic observations- surface and upper air, Tropical meteorology: Easterly Waves, ET-ITCZ, Inversion. Monsoon – Onset, Activity, Withdrawal, Breaks, Depressions, Easterly Jet Stream. Post Monsoon - Cyclones in the Indian Seas, N. E. Monsoon

**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)
2. South West Monsoon" by Y.P. Rao (IMD 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

## 501 084 –F- Elective –I Economics and Finance for Engineers (1Credit Course)

**Module1:**

**Introduction & Basics of Economics & Finance:** Meaning & necessity of: Economics, Costing & Finance, History & fundamentals of Economics, Basics of Finance & Accounting, rates of interest, Basics of Financial Statement, Financial Analysis, Inflation, etc.

**Module2:**

**Principles of Costing, Estimation & Valuation:** Basics of Costing, activity based costing & case studies, Basics of Estimation & Valuation, present & future values of properties, Profitability & Financial Decisions, Inventory Management

**Reference**

1. As specified by the instructor

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

**Module1:**

**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

**Module2:**

**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**

1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
2. Jumelage-I workbook by Roopa Luktuke

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

**Module1:**

**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

**Module2:**

**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**

1.Ethics in Enginerring Practice and Research---Carolin Whitbeck—Cambridge University Press—ISBN—978-1-107-66847-8

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

**Module1**

**Introduction to Intellectual Property Rights**

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

**International Scenario**

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

**Module 2**

**Patent Rights**

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**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**

1 Prabuddha Ganguly, " Intellectual Property Rights",Tata Mc-Graw Hill.
2 Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007
3 Robert P. Merges, Peter S. Menell, Mark A. Lemley "Intellectual Property in New",

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

**Module 1**

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

**Module 2**

A) Brihatsamhita – Aadhyay 21:– 31 to 37 sholkas
Aadhyay 22:– 1to 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**

Concepts and Theories, Communication concepts, Process and Function, Interpersonal & Intra personal, Group behaviour, need for Mass Communication. Relevance of Communication Theories to Practice, Models of Communication, Impact and Effect of Communication Old and new media, Communication Techniques, - Feedback and Evaluation of Communication Effect, Interview and Questionnaires- Method of Data Analysis, use of Information Technology, various methods of mass communication like seminars, conferences, print and digital media, internet, CDs, DVD, movies, U-tube, video conferencing.

**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**

1.Richard Dimbleby and Graeme Burton, 1995, More than words: An introduction to communication, London: Routledge.
2. Melvin L. DeFleur and Everette E. Dennis, 1991, Understanding mass communication, New Delhi: Goyal Saab.
3. Marshall McLuhan, 1964, Understanding Media, New York: McGraw –Hill
4. Wilbur Schramm, 1964, Mass media and national development, the role of information in developing countries, Stanford: Stanford University Press.
5. Holman, Tomlinson, Sound for film and television, Focal Press

6. McCormick, Tim and Rumsey, Francis, Sound and recording: An introduction, Focal Press
7. Talbot-Smith, Michael, Sound engineering explained, Focal Press
8. Talbot-Smith, Michael, Sound assistance, Focal Press
9. Altman, Rick, ed., Sound theory sound practice, Routledge Talbot-Smith, Michael, Sound engineer's pocket book, Focal Press
10. Truebitt, Rudy and David, Trubitt, Live sound for musicians,
11. Hal Leonard Nathan, Julian, Back to basic audio,
12. Newnes Yewdall, Lewis, David, Practical art of motion picture sound, Focal Press
13. Leider, N., Colby, Digital audio workstation, McGraw-Hill

**501 084 -- L--Elective I Yoga and Meditation (Audit course--Non Credit course)**

**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, Ardhachandrasan, 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-VilomPranayam, UjjayiPranayam, BhramariPranayam, BhastrikaPranayam, AgnisarPranayam, KapalbhatiPranayam, Meditation(Dhyan).

**References Books:**

Light on Yoga: by B.K.S. Iyengar, Harper Collins Publishers India

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

**Reference Web Sites:**

1. http://www.artofliving.org/in-en/yoga
2. http://www.artofliving.org/in-en/yoga/sri-sri-yoga/sukshma-yoga-relaxation
3. http://www.yogsansthan.org/
4. http://www.yogapoint.com/
5. http://www.divyayoga.com/
6. http://www.yogaville.org/about-us/swami-satchidananda/
7. http://www.yogaVision.net
8. http://www.swamij.com

**UNIVERSITY OF PUNE**

## M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER I**

**501 085 : Lab.Practice–I**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| **Lectures: 4 hours/week** | **Term work : 50 Marks** |
| **Credits : 4** | **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** atleast 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.
9. Physico-Chemical analysis of water (**Any five experiments**) Turbidity, Solids: Dissolved, Suspended, pH, Electrical Conductivity, Alkalinity and acidity, Hardness, Sulphate, Iron and Manganes, Optimum dose of alum, MPN Number.
10. Determination of cations, anions and any one heavy metal from water.
11. Sample collection methods and standardization of chemicals.

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# M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER II**

## 501 086 : Environmental Hydraulics and Environmental Structures

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 4 hours/week** | **In semester Exam: 50 Marks** |
| **Credits 4** | **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 application s of different types of valves such as pressure control valve, flow control valve, direction control valve, their application, 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 different type 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, Thyrister , Displacement and positioning sensor such as LVDT, RVDT, Tachometer, Dopler velocity meter.

**Module 4**

**Different Operation in Process:**

Heat Transfer: Heat exchanger design, finding LVDT , multiple heat exchanger, Diffusion (Mass Transfer Operation)and Distillation: Ficks law, molecular diffusion, gas and liquid study state diffusion, Concept of distillation, Design of distillation column, boiling point diagram, vapour – liquid equilibrium Drying : Humidification and de humidification, types of dryers, Filteration : Introduction to filter press, types of filtration, design of hydraulic filter press Adsorption : Adsorption – Basic Principle and Equilibrium in adsorption. Types of adsorption – Physical and Chemical Adsorption Isotherms- Langmuir and Freundlich, Ion Exchange: Techniques and applications, Equilibrium and rate of ion exchange, equipments, Crystallization: Principle rate of crystal growth, population balance and size distribution. (Including numerical)

**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, Lame„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**


1. Dynamics of structure theory and application to earthquake engineering- A.K. Chopra- Prentice Hall Publication.
2. Structure Dynamic -Mario Paz CBS Publication
3. Unit Operation by G.K. Ghavane
4. Water and Waste Water Engineering - Metcalf Eddy – Tata Mc Graw Hill Publication
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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## M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER II**

### 501 087: Hydrology

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 4 hours/week** | **In semester Exam: 50 Marks** |
| **Credits 4** | **End Sem. Exam. : 50 marks** |
| | **Duration of end semester exam.: 3 hrs.** |

**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 & it's 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**


1. Applied Hydrology-Linsley Kolhar & Paulhas (Mc-Graw Hill)
2. Water Resource & Hydrology-S.K. Garg.
3. Engineering Hydrology-K. Subramanya, Tata Mc-Graw Hill.
4. Elementry Engineering Hydrology—M.J.Deodhar--- Pierson Edution
4. Hydrology- H.M. Raghunath, Wily Eastern, New Delhi.
5. Stochastic Hydrology-Jaya Rami Reddy, Laxmi Pub., New Delhi.
6. Applied Hydrology-V.T. Chow, McGraw-Hill Book Company.
7. A text book of Hydrology- Jaya Rami Reddy, University Science Press
8.Ground water Hydrology---D.V.Todd---Wieley,India.
9 Numerical Groundwater Hydrology-----A.K.Rastogy.---Penram Internal Publishing(India).


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## M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER II**

### 501 088 : Open Channel Hydraulics

| Teaching Scheme | Examination Scheme |
|---|---|
| Lectures: 4 hours/week | In semester Exam: 50 Marks |
| Credits 4 | 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, Clacification 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.
2. Flow through Open Channel-K.G.Ranga Raju, Tata Mc-Graw Hill.
3. Flow in Open Channel – K. Subramanya, Tata Mc-Graw Hill.
4.Flow through open channels—Rajesh Srivastava—Oxford University Press
5. Open Channel Hydraulics-French, Mc-Graw Hill.

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**501 089 : ELECTIVE –II**

**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:3Hrs**

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

| Code | 2 Credits | Code | | Code | Audit Course |
|---|---|---|---|---|---|

| | **Course**<br><br>*L* | | **1 Credit Course** | | **(No Credit Course)** |
|---|---|---|---|---|---|
| 501089<br>**A** | Human Rights | 501089<br>**E** | Foreign Language II | 501089<br>**I** | Performing Arts – Music and Dance |
| 501089<br>**B** | Mechanics of Waves | 501089<br>**F** | Industrial Safety | 501089<br>**J** | Principle Centred Leadership |
| 501089<br>**C** | Water Management | 501089<br>**G** | Noise Pollution and Control Techniques | | |
| 501089<br>**D** | Environmental Geotechnology | 501089<br>**H** | Sanskrit II | | |

**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
2.Human Rights in India- A Mapping ,Usha Ramanathan: free download from http://www.ielrc.org/content/w0103.pdf
3.Introduction to International Humanitarian Law by Curtis F. J. Doebbler - CD Publishing , .
4.Information, by Toby Mendel - UNESCO , 2008
**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 of selected topic from syllabus.

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

**Module 1**
Introduction, Generation, Decay, Classification, Measurement, Wave Forecasting: The Significant Wave, Simplified versus Elaborate Technique, Simplified Methods- SMB method, Hasselmann method, Darbyshire and Draper's Technique, Forecasting in Hurricanes, Numerical Wave Modeling (introduction only, no mathematical treatment): Phase resolving models, Phase averaging models
**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**
Wave spectrum analysis, wave spectra and statistics, Theoretical spectra: Pierson-Muskowitz Spectrum, Bretschneider Spectrum, JONSWAP Spectrum, Scott Spectrum, Scott-Wiegel Spectrum
Wave statistics: Short term wave statistics, Tucker method, Long term wave statistics- Gumbel distribution, Weibull Distribution, Log Normal Distribution, Fretchet Distribution, Upper bound Type III u distribution, Long Term Distribution of Individual Wave Heights
**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**
1.Sarpkaya, T., Issacson, M. (1981). “Mechanics of Wave Induced Forces on Offshore Structures”,Van Nostrand Reinhold.
2.U.S. Army Corps of Engineers. (2002). “Coastal Engineering Manual”, U.S. Army Corps of Engineers, Washington, D.C.
3.WMO. (1988). “Guide to Wave Analysis and Forecasting”, Pub. NO. 702, World Meteorological

Organization, Secretariat of WMO, Geneva.
4.Dean, R. G., Darlymple R. A. (1991). "Water Wave mechanics for Engineers and Scientists", Scientific Sorensen, R. M. (1997). "Basic Coastal Engineering", Springer

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## 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 owner ship, 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**

1. Water Resources Systems Engg, D. P. Loucks, Prentice Hall
2. Chaturvedi, M.C. " Water Resources Systems Planning and Management" Tata McGraw Hill
3. James L.D and Lee R.R " Economics of Water Resources Planning", McGraw Hill
4. Water resources hand book; Larry W. Mays, McGraw International Edition

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## 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

Geosynthetics - types, functions, properties and functional requirements. Design and Application of geosynthetics in geo-environment, Reinforced soil Mechanism, Applications–reinforcement soil structures with vertical faces, reinforced soil embankments. Reinforcement soil beneath unpaved roads, reinforcement of soil beneath foundations, Open excavation and slope stabilization using soil nails. (Including numerical)

**References Books**


1. Hazardous Waste Management - Wentz, C.A., McGraw Hill, Singapore, 1989.
2. Geotechnical Practice for Waste disposal - Daniel, B.E., Chapman and Hall, London, 1993
3. Proceedings of the International symposium of Environmental Geotechnology Vol.I and Vol.II- Environmental Advance Soil Mechanics – Braja Mohan Das- Tata Mc- Grawhill
4. Geotechnical Engineering - Shashi K. Gulati & Manoj Datta – Tata Mc-Graw Hill
5. Basic and Applied Soil Mechanics- Gopal Ranjan & A.S. Rao- New Age Pub.


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## 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**


1. Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
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**

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation –communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

**References**

1. Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982
2. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
3. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
4. John Ridley, "Safety at Work", Butterworth & Co, London, 1983
5. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973

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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

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

**Module 1**
A) Brihatsamhita – aadhyay 53: 1 to 20 sholkas
B) Brihatsamhita – aadhyay 53:– 21 to 40 sholkas
**Module 2**
A) Brihatsamhita – aadhyay 53:– 40 to 60sholkas
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

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

**Module 1 :**
**Indian Music**
Vocal, Instrumental, Sur, Laya, Tal. Ragas and their classification based on time and "Raasa-Nirmitee". Seasons and Ragas. Various "Bandishes" and "Gharanas" or styles. Light Indian Music-different types.
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, Odissy 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

1. Hindustani Sangeet Paddhati by Pt.Vishnu Narayan Bhatkhande publ. Swarganga Foundation.
2. Jivi Jivai (Golden Voice Golden Years) Pt.Jasraj, Publ. Bandishes with notations composed by the author.
3. Pranav Bharati, by Pt.Ompraksh Thakur, publ. Swarganga foundation.
4. Rasa Gunjan by Pt.Birju Maharaj, Publ. Swarganag foundation
5. Anup Rag Vilas by Pt.Kumar Gandharava, Bandishes composed and sung by author mostly available on cassettes Swarganga Foundation.
6. The dance Orissi – Mohan Khokar published by (2010) Abhinav Publications, New Delhi

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
9. Tantra Mantra Yantra in Dance: An Exposition of Kathaka, by Ranjana Shrivastava, D.K.Prinword Pvt. Ltd.

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

**Module 1 :**
**Motivation, Leadership and Competency**

**a) Motivation:--**

Necessity, types, means of providing extrinsic motivation. Leadership. Qualities of a leader. Types of Leadership viz. Lassez Fairre, transactional, transformational. Principle centered leadership based on Stephen Covey habits.

**b) Competency Mapping:-**

Definition of competency. Generic, functional and Strategic Competencies. Importance of developing competencies. Identification of competency gaps at managerial cadre level through benchmarking requirements based on role, mapping and assessment. Training and Developmental programs for competency gap closure.

**Module 2 :**
**Entrepreneurship and strategic Management**

**a) Entrepreneurship: -** Qualities of an entrepreneur. Business ideas generation methods—creative imagination, brainstorming, newspaper exercise activity. Ideas evaluation based on John Mullion's 7 point test concept of a B—plan.

**b)Strategic Management: --**

Necessity in the context of global challenges. Objectives of strategic management. Forecasting abilities and methods. Developing organizations for the achievement of strategic objectives. Dealing with uncertainties.

**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
4. Human Resource Development In The Building Industry, Vinita Shah, published by NICMAR
5. Human Resources Management & Human Relations , V P Michael , Himalaya
6. Human Resource Management Biswajeet Pattanayak published by Prentice Hall
7. Construction project Management, integrated approach—Feedings First Indian Reprint 2011—Yesdee publications
8. Cases in Strategic Management, Amita Mital , Tata Mcgraw Hil


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**UNIVERSITY OF PUNE**

## M.E. (CIVIL) (Water Resource and Environmental Engineering)
**SEMESTER II**

**501 090 -Lab.Practice–II**

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 4 hours/week** | **Term work : 50 Marks** |
| **Credits : 4** | **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 ($NH_3$)
9. Determination of heavy metal from Waste Water (any heavy metal)
10. Determination of phosphate and nitrate
11. Determination of pH, moisture content of solid waste.

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**UNIVERSITY OF PUNE**

## M.E. (CIVIL) (Water Resource and Environmental Engineering)
**SEMESTER II**

**501 091-Seminar – I**

| Teaching Scheme | Examination Scheme |
|---|---|
| Pract. 4 hrs./week | 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 vacational 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 | Examination Scheme |
|---|---|
| **Lectures: 4 hours/week** | **In semester Exam: 50 Marks** |
| **Credits 4** | **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, necessicity, 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**

**Theory & design of secondary treatment units:** Introduction to unit process and unit operations for secondary treatment. Biological principle, important microorganisms in waste water & their importance in waste water treatment systems, bacterial growth, general growth pattern, growth in terms of bacterial numbers and bacterial mass. Kinetics of biological growth, cell growth, substrate limited growth, cell growth and substrate utilization, effect of endogenous metabolism. Activated sludge process: Design of ASP, sludge volume index, sludge bulking & control. Types of ASP (Including numerical)

**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.

Theory and design of rotating biological contactor (RBC)Low cost treatment methods: Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds. Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated lagoons. Introduction and theory of Phytoremediation technology for wastewater treatment, Introduction and theory of root zone cleaning system. (Including numerical)

**Module7**

**Theory & design of anaerobic treatment units**

Septic tanks, suitable conditions & situations, biological principle, method of treatment & disposal of septic tank effluent. Design of septic tank along with up flow filters and soak pit, Anaerobic digester: Principal of anaerobic digestion, stages of digestion, bio – gas production its characteristics & application, factors governing anaerobic digestion, Design of anaerobic digesters. Such as gravity thickener, sludge drying bed, decanters. Methods of sludge treatment and disposal, advantages & disadvantages, Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages, removal of phosphate and nitrate from waste water

**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**


1. Wastewater Engineering: Treatment, Disposal & Reuse, By Metcalf & Eddy Inc. Sixth Ed. 2002, McGraw Hill
2. Introduction to Environmental Engg, By. P.A. Veslind, PWS, Publishing Company, Boston, 1997
3. Wastewater Treatment and disposal, By S.J. Arceivalla, Marcel Dekker, 1981.
4. Wastewater Treatment Plant Planning, Design and Operation, By S.R. Quasim, Holt, Rinehart & Winston N.Y.
5. Activated Sludge Process: Theory and Practices, By N.F Grey, Oxford
6. Water Supply Engg by Dr. B.C.Punmia ,Laxmi Publicaiton
7. Water supply Engg. By S.K. Garge, Khanna Publication.

**UNIVERSITY OF PUNE**

# M.E. (CIVIL) (Water Resource and Environmental Engineering)

**SEMESTER III**

## 601 093-Dam Engineering

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 4 hours/week** | **In semester Exam: 50 Marks** |
| **Credits 4** | **End Sem. Exam. : 50 marks** |
| | **Duration of end semester exam.: 3 hrs.** |

**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**
Differenent 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:3Hrs**

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

| Code | 2 Credits Course | Code | 1 Credit Course | Code | Audit Course (No Credit Course) |
|---|---|---|---|---|---|
| **601 094A** | Optimization Techniques | **601 094E** | Project Funding | **601 094H** | Chess |
| **601 094B** | Ground Water Modelling | **601 094F** | Foreign Language-III | **601 094I** | Abacus |
| **601 094C** | Solid and Hazardous Waste Management | **601 094G** | . Rural Engineering | | |
| **601 094D** | Industrial Waste Management | | | | |

## 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**

1. Engineering Optimazation Theory & Practice – S.S. Rao., Wiely.
2. Operation Research – Taha Hamdey A.
3. Principles of Operation Research – Wagner, Prentice Hall.
4. Operation Research – Hira and Gupta, S.Chand

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## 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, utilizable 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**

1. Remson, I., Hornberger, G.M., and Molz. F.J., Numerical methods in sub-surface hydrology, Wiley Inter Science
2. Rushton, K.R. and Redshaw, S.C., Numerical analysis by analog & digital methods, John Wiley.
3. Todd, D.K., Groundwater Hydrology, John Wiley, 1980.
4. Groundwater Modeling by Anderson.
5. Numerical ground water modeling by A K Rastogi, Penram International Publishing (India). 2007

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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:**

Transfer station: Meaning, Necessity, Location, Economic analysis. Transportation of solid waste: Means and methods, Routing of vehicles. Objectives of Sorting and material recovery, Stages of sorting, Sorting operations, Guidelines for sorting for material recovery, Typical material recovery facility for a commingled solid waste.

**Composting of solid waste:** Principles, Methods, Factors affecting, Properties of compost, Vermicomposting. Energy recovery from solid waste: Parameters affecting, Biomethanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options.

**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

**Definition and identification of hazardous wastes** - sources and characteristics - hazardous wastes in Municipal Waste - Hazardous waste regulations -minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste - collection and transport.

**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**


1. Manual on municipal solid waste management – Government of India publication.
2. Integrated solid waste management – George Tchobanoglous, Mcgraw Hill
3. Solid waste management handbook– Pavoni
4. Gorge Techobanoglous et al "Integrated solid Waste Management" Mc Graw Hill Publication 1993.
5. Charles A Wentz " Hazardous Waste Management "Mc Graw-Hill Publication 1995.
6. Sukhatme S.P.- Solar Energy.
7. Kiang Y. H.- Waste Energy Utilization Technology.


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**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**

1 Waste Water Engineering, Metcalf Eddy Mc Graw Hill Publications.
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

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**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

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**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)**

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**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 Swarozgar 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

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**601 094-I-Elective III Abacus (Audit Course---No Credit course)**

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**Module 1**

Introduction of Abacus, addition & subtraction with help of 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

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**UNIVERSITY OF PUNE**

**M.E. (CIVIL) (Water Resource and Environmental Engineering)**

**SEMESTER III**

**601 095 Seminar – II**

| Teaching Scheme | Examination Scheme |
|---|---|
| Pract. 4 hrs./week | 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

**UNIVERSITY OF PUNE**

**M.E. (CIVIL) (Water Resource and Environmental Engineering)**

**SEMESTER III**

**601 096 Project Stage I**

| Teaching Scheme | Examination Scheme |
|---|---|
| Pract. 8 hr./week | Oral: 50 marks, |
| | TW ; 50 marks |
| | Credits 8 |

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 | Examination Scheme |
|---|---|
| Pract. 5 hrs./week | 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 | Examination Scheme |
|---|---|
| Pract. 20 hrs./week | Oral/Presentation : 50 Marks |
| | TW : 150 Marks |
| | Credits : - 20 |

The final dissertation should be submitted in black bound hard copypreferably 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 IVwill be assessed jointly by the pair of internal and external examiners, along with oral examination of the same.