University of Pune

SYLLABUS

OF

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

To be effective from

July 2013

M.E. Civil (Water Resource and Environmental Engineering)
2013 Course

COURSE STRUCTURE

SEMESTER I

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

SEMESTER –II

Code	Subject	Teaching Scheme	Examination scheme					Credits
		Lect./ Practical	Paper		TW	Oral/Presentation	Total	
			In Semester Assessment	End Semester Assessment				
	Environmental Hydraulics and Environmental Structures	4	50	50	--	--	100	4
	Hydrology	4	50	50	--	--	100	4
	Open Channel Hydraulics	4	50	50	--	--	100	4
	Elective II	5	50	50	--	--	100	5
	Lab Practice II	4	--	--	50	50	100	4
	Seminar I	4	--	--	50	50	100	4
	Total	**25**	**200**	**200**	**100**	**100**	**600**	**25**

SEMESTER –III

Code	Subject	Teaching Scheme	Examination scheme					Credits
		Lect./ Practical	Paper		TW	Oral/Prese ntation	Total	
			In Semester Assessment	End Semester Assessment				
	Advanced Water and Waste Water Treatment	4	50	50	--	--	100	4
	Optimization Techniques	4	50	50	--	--	100	4
	Elective III	5	50	50	--	--	100	5
	Seminar II	4	--	--	50	50	100	4
	Project Stage I	8	--	--	50	50	100	8
	Total	**25**	**150**	**150**	**100**	**100**	**500**	**25**

SEMESTER –IV

Code	Subject	Teaching Scheme	Examination scheme					Credits
		Lect./ Practical	Paper		TW	Oral /Presentatio n	Total	
			In Semester Assessment	End Semester Assessment				
	Seminar III	5	--	50	50	100	100	
	Project Work Stage II	20	--	150	50	100	100	25
	Total	**25**		**200**	**100**	**200**	**500**	**25**

***** 1 credit = 15 contact hours (Th & Pr)****

Elective-I		Elective-II		Elective-III	
Section-I (Credits = 2) *Technical*	*Section-II (Credits 1) Inter-Disciplinary*	*Section-I (Credits = 2)* *Technical*	*Section-II (Credits =1) Inter-Disciplinary*	*Section-I (Credits = 2)* *Technical*	*Section-II (Credits =1) Inter-Disciplinary*
A)Computational Methods B) Energy and Environment C) Remote Sensing and Geographical Information System D) Climate change	A) Cyber Security -I B) Industrial safety -I C) Economics & Finance For Engineers D)Foreign Language -I E)Engineering Ethics F)Intellectual Property Rights G)Sanskrit-I	A) Wave mechanics B) Water Management C) Environmental Geotechnology D) Noise Pollution and Control Techniques	A) Human Rights -I B) Cyber Security II C) Industrial Safety II D) Yoga and Mediation- I E) Foreign Language II F) Rural Engineering I G) Sanskrit II	A) Dam Engineering B) Ground Water Modelling C) Solid and Hazardous Waste Management D) Industrial Waste Management	A) Human Rights-II B) Yoga and Mediation -II C) Foreign Language- III D) Personality development E) Corporate Soft skills F) Project Funding G) Rural Engineering-II H) Chess I) Abacus

Compulsory Modules

EXAMINATION SCHEME

Compulsory subjects: Credits 4
Total marks: 100
In semester assessment: 50 (comprising of 2 tests + quiz + assignments+----) to be done by institute
End semester assessment: 50 (theory paper) conducted by the University
Suggested pattern:
In semester assessment: On 4 units
End semester assessment: Question 1 or Question 2 of 18 marks on Units 1-4 with internal options
Question 3 or 4: Unit 5- 16 marks
Question 5 or 6: Unit 6- 16 marks (total 50 marks)

Elective: Credits 5 (section 1 Technical + section 2 Non-tech)
Total marks: 100 (entire assessment to be done at the institute level)

Elective subjects: Credits 2 (Technical)
In semester assessment: 50 % weightage
End semester assessment: 50%

Elective subjects: Credits 1 (Non-Technical)
In semester assessment: 50 % weightage
End semester assessment: 50%

SYLLABUS
Semester I

PLANNING AND MANAGEMENT OF WATER RESOURCES

Teaching Scheme   **Examination Scheme**

Lectures: 4 hours/week   **Credits: 4**

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

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

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

Unit 4 Management of Water Resources: Characteristics and functions of reservoir; reservoir sedimentation; conservation storage; conflict among uses, Reservoir operation studies - effect on river regime; long term simulation; reliability; resiliency and vulnerability assessment

Unit 5 Management of Ground-Water Resources: Ground water evaluation; conjunctive use of surface and ground water.

Unit 6
Discounting techniques; benefit cost parameters; estimation of benefits and costs; appraisal criteria; social benefit cost analysis. Basin planning; inter-basin transfer of water

Reference
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.

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

Teaching Scheme   **Examination Scheme**

Lectures: 4 hours/week   **Credits: 4**

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

Unit 2 Chemical reaction ,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. 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)

Unit 3 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.

Unit 4 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.

Unit 5 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)

Unit 6 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
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

FLUID MECHANICS

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 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. 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 **(Numerical Problems should not be asked on unit No.1)**

Unit 2 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,

Unit 3 Laminar Flow:
Navier strokes equation-derivation, exact flow between parallel plates-it's exact solution, flow near an oscillating plate & suddenly accelerated plate.

Unit 4 Boundary Layer Theory:
Karman's momentum integral equation, Karman Pohelhausen's solution, boundary layer separation

Unit 5 Turbulent Flow:
Reynolds' equation of motion, typical solution, Energy and Momentum equation, Statistical theory of turbulence, Isotropic and homogeneous turbulence, probability density function

Unit 6 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, Normal shock in one dimensional compressible flow and compressible flow around immersed bodies

Reference
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

RESEARCH METHODOLOGY

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 1 Introduction:
Nature and objectives of research, Methods of Research: historical, descriptive and experimental, research process, research approaches, criteria for good research

Unit 2 Research Design:
Meaning of research design, need of research design, features of good design, different research designs, and basic principles of experimental designs, design of experiments

Unit 3 Data collection, Analysis and Processing:
Types of data, methods and techniques of data collection, primary and secondary data, meta analysis, historical methods, content analysis, devices used in data collection, pilot study and pretest of tools, choice of data collection methods.

Unit 4 Data Analysis and Processing:
Use of statistics for data analysis, measures of central tendency, dispersion, skewness and relationship, Sampling distributions, sampling theory, determination of sample size, chi-square test, analysis of variance, multiple regression analysis

Unit 5 Decision making techniques:
Application of various decision making techniques such as Analytical Hierarchy Process (AHP), TOPSIS, neural networks, graph theory, simulated annealing, genetic algorithms, data envelope analysis (DEA).

Unit 6

Interpretation and report writing: Techniques of interpretation, precautions in interpretation, significance of report writing, different steps in report writing, layout of research report, mechanics of writing research report.

Reference

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, New Delhi
3. Fisher, Design of Experiments, Hafner
4. J.W Bames, Statistical Analysis for Engineers and Scientists, McGraw Hill, New York
5. Donald Cooper, Business Research Methods, Tata McGraw Hill, New Delhi
6. Bhanwar Lal Garg, Renu Kavdia, Sulochana Agrawal and Umesh Kumar Agrawal, "An Introduction to Research Methodology", RBSA Publications,
7. Montgomery D.C., "Design and analysis of experiments", Wiley publications.

ELECTIVE I - SECTION I

COMPUTATIONAL METHODS

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

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

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

Unit-III 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

Unit-IV: 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

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.

ENERGY AND ENVIRONMENT

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

Unit 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.
Unit 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)
Unit 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)
Unit 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
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

REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

Unit 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.
Unit 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
Unit 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

Unit 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
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.

INTRODUCTION TO WEATHER AND CLIMATE

Teaching Scheme	**Examination Scheme**
Lectures: 2 hours/week	**Credits: 2**

Unit 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
Unit 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
Unit 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
Unit4:
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
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

ELECTIVE I-SECTION II

CYBER SECURITY- I

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I:
Overview of Networking Concepts And Information Security Concepts: Basics of Communication Systems, Transmission Media, Topology and Types of Networks, TCP/IP Protocol Stacks, Wireless networks and The Internet. Information Security Overview: Background and Current Scenario, Types of Attacks, Goals for Security, E-commerce Security, Computer Forensics, Steganography

Unit II:
Security threats and vulnerabilities, Cryptography / Encryption, Overview of Security threats, Weak / Strong Passwords and Password Cracking, Insecure Network connections, Malicious Code, Programming Bugs, Cyber crime and Cyber terrorism, Information Warfare and Surveillance, Introduction to Cryptography / Encryption, Digital Signatures, Public Key infrastructure, Applications of Cryptography, Tools and techniques of Cryptography

Reference:
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

INDUSTRIAL SAFETY – I

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I: 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.

Unit II: 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

ECONOMICS & FINANCE FOR ENGINEERS

Teaching Scheme	Examination Scheme
Lectures: 1 hours/week	Credits: 1

Unit 1: 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.

Unit 2: 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: As specified by the instructor

FRENCH-I

Teaching Scheme	Examination Scheme
Lectures: 1 hours/week	Credits: 1

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

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

Reference: Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
         Jumelage-I workbook by Roopa Luktuke

ENGINEERING ETHICS

Teaching Scheme	Examination Scheme
Lectures: 1 hours/week	Credits: 1

Unit 1: Introduction: Meaning & scope of Ethics in general & for engineers in particular, Work Culture, Corporate, local & global issues, Rights & responsibilities of Engineers, Conflicts in the profession, Mental Stresses & Emotional Intelligence

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

Reference: As specified by the instructor

<div align="center">**INTELLECTUAL PROPERTY RIGHTS**</div>

Teaching Scheme	**Examination Scheme**
Lectures: 1 hours/week	**Credits: 1**

Unit 1
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 cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.
Unit 2
International Scenario: Patent Rights, Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications, Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs
Reference:
1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd , 2007
2. Intellectual Property in New, Robert P. Merges, Peter S. Menell, Mark A. Lemley,

<div align="center">**SANSKRIT I**</div>

Teaching Scheme	**Examination Scheme**
Lectures: 1 hour/week	**Credits: 1**

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

<div align="center">**HYDRAULICS AND ENVIRONMENTAL LABORATORY – I**</div>

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. Study and use of GIS software in Environmental engineering
10. 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.
11. Determination of cations, anions and any one heavy metal from water.
12. Sample collection methods and standardization of chemicals.

ENVIRONMENTAL HYDRAULICS AND ENVIRONMENTAL STRUCTURES

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 1 Pumps, Compressor, Pipe size selection (Including numerical 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.

Unit 2 Valves, Actuators and Instrumentations:
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, 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.

Unit 3 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)

Unit 4 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.

Unit 5 Design of Cylinders and Pressure Vessels:
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), 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).

Unit 6 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
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

HYDROLOGY

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 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

Unit 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.

Unit 3 Flood Analysis:
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

Unit 4 Ground Water 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.

Unit 5 Ground Water Development:
Ground water Exploration, well types, well construction & design, screens, perforations & gravel packs, pumping equipment, quality of ground water, pollution of ground water

Unit 6 Ground Water Conservation:
Ground water budget, seepage from surface water artificial recharge

Reference
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. 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

OPEN CHANNEL HYDRAULICS

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 1
Review and revision of uniform flow formulae and design of channels

Unit 2 Hydraulic Jump:
Formations of jump in expanding and contracting channel, jump type, jump control, jump on sloping floors

Unit 3 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, finite difference method.

Unit 4 Spatially Varied Flow:
Differential Equation of spatially varied flow, profile computation.

Unit 5 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

Unit 6 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
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. Open Channel Hydraulics-French, Mc-Graw Hill.

ELECTIVE II-SECTION I

MECHANICS OF WAVES

Teaching scheme: **Examination Scheme:**
Lecture: 2 Hrs/week   **Credits: 2**
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Unit 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

Unit 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

Unit 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

Unit 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

Sarpkaya, T., Issacson, M. (1981). "Mechanics of Wave Induced Forces on Offshore Structures",Van Nostrand Reinhold.

U.S. Army Corps of Engineers. (2002). "Coastal Engineering Manual", U.S. Army Corps of Engineers, Washington, D.C.

WMO. (1988). "Guide to Wave Analysis and Forecasting", Pub. NO. 702, World Meteorological Organization, Secretariat of WMO, Geneva.

Dean, R. G., Darlymple R. A. (1991). "Water Wave mechanics for Engineers and Scientists", World Scientific

Sorensen, R. M. (1997). "Basic Coastal Engineering", Springer

WATER MANAGEMENT

Teaching Scheme   **Examination Scheme**

Lectures: 2 hours/week   **Credits: 2**

Unit 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.

Unit 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.

Unit 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

Unit 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

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

ENVIRONMENTAL GEOTECHNOLOGY

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

Unit 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)

Unit 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)

Unit 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)

Unit 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
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.

NOISE POLLUTION AND CONTROL TECHNIQUES

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

Unit 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)

Unit 2

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)

Unit 3

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)

Unit 4

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

ELECTIVE II-SECTION II

HUMAN RIGHTS I

Teaching Scheme   **Examination Scheme**

Lectures: 1 hours/week   **Credits: 1**

Unit 1: Brief history of Human Rights

International and national perspectives, Human Values – Dignity, Liberty, Equality, Justice, Unity In Diversity, Ethics And Morals. Rights:-Inherent-Inalienable-Universal-Individual and Groups. Nature and concept of duties, International relationship between Rights and Duties, Universal declaration of Human Rights-Significance-Preamble, Meaning of Legal Instrument –Binding Nature, Types of Instruments –Covenant –Charter-Declaration- Theory-Convention Protocol- Executive Orders and Statues, Provision of charter of the United Nations

Unit 2: Human rights and vulnerable groups

Civil and Political rights, Economic-social and cultural rights, Limitations of Duties, Final Provision, Introduction of different vulnerable groups, Customary, Social, Economic, Cultural problems of Vulnerable groups. Status of women and children in international and national perspective, Status of socially and economically disadvantaged people

References

1. Human Rights Reference Handbook by University of peace,

2. Introduction to human rights and duties by Dr. T.S.N. Sastry.

3. Human Rights in the Administration of Justice: A Manual on Human Rights for Judges, Prosecutors and Lawyers

4. Universal Declaration of Human Rights. UN/DPI. ISBN: 92-1-100760-

5. Human Rights: A Compilation of International Instruments. Regional Instruments. Volume 2

. ISBN: 92-1-154124-7

CYBER SECURITY- II

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I:

Security Management Practices, Security Laws:

Overview of Security Management, Information Classification Process, Security Policy, Risk Management, Security Procedures and Guidelines, Business Continuity and Disaster Recovery, Ethics and Best Practices, Security Assurance, Security Laws, IPR.

Unit II:

Access Control, Intrusion Detection and Server Management, Firewalls:

Overview of Identification and Authorization, Overview of IDS, Intrusion, Detection Systems and Intrusion Prevention Systems, User Management, Overview of Firewalls, Types of Firewalls, DMZ and firewall features

Reference:

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

INDUSTRIAL SAFETY - II

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I: Occupational Health and Hygiene Physical Hazards

Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometric, hearing conservation programs vibration

Chemical Hazards

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard.

Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education

Biological and Ergonomical Hazards

Classification of Bio hazardous agents –bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design

Unit II: Occupational Health And Toxicology

Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests.

Occupational Physiology

Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene

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

YOGA AND MEDITATION-I

Teaching Scheme	**Examination Scheme**
Lectures: 1 hours/week	**Credits: 1**

Unit I: Introduction and History/traditions related to Yoga & Meditation, Simple Asanas & Meditation, Importance of Yoga & Meditation in Modern life, Dandak (Standing Posture) Asanas, Baithak (Sitting Posture) Asanas, Pranayam – KumbhakyuktaPranayam, Meditation - Omkarsadhana

Unit II: Other Asanas / Yoga & Meditation, Yoga Pravesh, Shayan Asanas, Vipareet-Shayan Asanas, Shuddhikriya, Basics of Meditation

Reference: As specified by the instructor

FRENCH-II

Teaching Scheme	**Examination Scheme**
Lectures: 1 hours/week	**Credits: 1**

Unit 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

Unit 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: Jumelage-I Text Book by Manjiri Khandekar & Roopa Luktuke (Latest edition)
          Jumelage-I workbook by Roopa Luktuke

RULER ENGINEERING-I

Teaching Scheme	**Examination Scheme**
Lectures: 1 hours/week	**Credits: 1**

Unit I: Ruler Development and Infrastructure development.

Introduction to ruler engineering, elements of ruler engineering, productivity, animal husbandry and agriculture, ruler 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.

Unit II: Human Resources and development.

Health care center, ruler sanitation, combined program me for women and pre school children. Employment generation, integrated ruler development programme, landless employment guarantee program me, present ruler status, role of NGO and corporate sector.

Reference: As specified by the instructor

SANSKRIT- II

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I
A) Brihatsamhita – aadhyay 53: 1 to 20 sholkas
B) Brihatsamhita – aadhyay 53:– 21 to 40 sholkas
Unit II
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

HYDRAULICS AND ENVIRONMENTAL LABORATORY – II

1. Characteristics of Hydraulic Jump in horizontal and sloping channel
2. Velocity distribution in open channel flow using pitot tube or current meter
3. Use of open channel flow simulation software like 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.
12. Visit to water and waste water treatment plant.

ADVANCED WATER AND WASTE WATER TREATMENT

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 1 Introduction:
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

Unit 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)

Unit 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)

Unit 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)

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)

Unit 5 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)

Unit 6 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

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.

OPTIMIZATION TECHNIQUES

Teaching Scheme   **Examination Scheme**
Lectures: 4 hours/week   **Credits: 4**

Unit 1
Linear Programming I: Introduction to Optimization techniques, Linear programming basic concepts, graphical method, Simplex method
Unit 2
Linear Programming II: Big M Method, Two phase method, Duality, sensitivity analysis. Application of Linear Programming to Hydraulics & Water Resource
Unit 3
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
Unit 4
Dynamic Programming:
Principle of optimality, recursive equations

Unit 5 Stochastic Methods:
Queuing theory, simulation technique, sequencing model
Unit 6 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

ELECTIVE III-SETION I

DAM ENGINEERING

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**
Unit 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
Unit 2 Arch Dams:
General concepts of trail load theory, elastic shell methods, thick cylinder theory
Unit 3 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.
Unit 4 Rock fill Dams:
Relevant rock fill characteristics, general design principal method of construction and compaction.
Buttress Dam: Concepts and Design
Reference
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

GROUND WATER MODELLING

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

Unit 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/caliper/fluid conductivity/fluid velocity/miscellaneous logging. (Including numerical)

Unit 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

Unit 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

Unit 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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SOLID AND HAZARDOUS WASTE MANAGEMENT

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Teaching Scheme	**Examination Scheme**
Lectures: 2 hours/week	**Credits: 2**

Unit 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.

Unit 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)

Unit 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.

Unit 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
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.

INDUSTRIAL WASTE MANAGEMENT

Teaching Scheme   **Examination Scheme**
Lectures: 2 hours/week   **Credits: 2**

Unit 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)

Unit 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)

Unit 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)

Unit 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

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

<u>ELECTIVE III- SECTION II</u>

HUMAN RIGHTS II

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit 1: Human rights and special category of Vulnerable Groups

Human rights and special category of Vulnerable Groups: stateless persons, migrant workers. Indian Bill of rights of Gokhale and Sarvodaya, Human Rights Act.1933, Judicial Organs :Supreme Court and High Court. Human rights commission – National and State of Maharashtra. Commissions of women, children, minority, SC/NT

Unit 2: Human rights violations and Indian policy

Human rights violations and Indian policy:-Inequality in society-population- illiteracy-poverty-caste – inaccessibility of legal redress. Abuse of executive power- corruption-nepotism and favoritism. Human rights and good governance, Role of Advocacy groups: Professional bodies(like press, media), role of lawyers – legal aids, educational institutes, Corporate sector, NGO's.

References

1. Human Rights Reference Handbook by University of peace,
2. Introduction to human rights and duties by Dr. T.S.N. Sastry.
3. Human Rights in the Administration of Justice: A Manual on Human Rights for
   Judges, Prosecutors and Lawyers
4. Universal Declaration of Human Rights. UN/DPI. ISBN: 92-1-100760-
5. Human Rights: A Compilation of International Instruments. Regional Instruments. Volume 2
. ISBN: 92-1-154124-7

YOGA AND MEDITATION-II

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I: Necessityand advantages of Yoga & Meditation, Dhyanatmak Asanas, Yoga Parichay, Dhyanatmak Baithak Asanas, Dyanatmak Shayan Asanas, Pranayam – BandhayuktaPranayam, Shavasana & Yognidra
Unit II: Other Asanas, Sooryanamaskar & Meditation, Ashtang-Yoga, Sooryanamaskar, Dyanatmak Vipareet-ShayanAsanas, Mudrabhyas, Practicing the Meditation Techniques
Reference: As specified by the instructor

FRENCH-III

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I: 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
Unit II: 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

PERSONALITY DEVELOPMENT

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**
Unit I: Introduction& Basics: Meaning & necessity of P.D., Resume Writing, Interpersonal Skills & Working in a Team, Presenting Yourself (Dress Code, Body Language, etc.)
Unit II: Management Techniques for Personality Development: Goal Setting &Positive attitude, Interview Skills & Verbal Communication, Time & Task Management, Memory Management
Reference: Will be specified by instructor

CORPORATE SOFT SKILLS

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit1: Introduction: Work Culture in general & specific to the Corporate, Interpersonal Skills & Verbal Communication, Emotional Intelligence& its use, Attitude & Team building
Unit 2: Additional Management Skills, Leadership & Resolving Conflicts, Corporate Communication Skills, Positive attitude, Counselling & Motivation Skills, Performance Enhancement Skills

Reference: As specified by the instructor

PROPOSAL WRITING

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit 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.

Unit 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

RULER ENGINEERING-II

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit I: Socio Economic Development
Ruler population growth rate, ruler literacy, manpower, cultivators, agriculture, industrial worker, manufacture worker, rural poverty. Five years plan for ruler development.
Unit II: Govt. Policy and schemes for Ruler development.
Various policies for ruler development, various schemes such as micro finance and ruler banking, integrated village development model, Swaranjayanti Gram Swarozgar Yojana, Samparan Grammen Rozgar Yojana, Micro finance and ruler banking
Reference: As specified by the instructor

CHESS

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit 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
Unit 2
End game, attacking a piece, Opening principles, Piece exchange, Pin, Defining the draws in Chess
Reference: As specified by the instructor

ABACUS

Teaching Scheme   **Examination Scheme**
Lectures: 1 hours/week   **Credits: 1**

Unit 1
 Introduction of Abacus, addition & subtraction with help of help of small friends, big friends & big family, Concept of visualization, Multiplication & Division
Unit 2
 Additional & Subtraction with decimal concept, Determine cube root & square root
Reference: As specified by the instructor