UTTAR PRADESH TECHNICAL UNIVERSITY
LUCKNOW

SYLLABUS

of

B. Tech Environmental Engineering
(2nd Year)

[Effective Form session 2014-15]

Study and Evaluation Scheme

B. Tech Environmental Engineering
[Effective from Session 2014-15]
Second Year, Semester III

S. No.	Subject Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CA	TA	Total			
Theory Subject											
1	NAS-301/ NOE-031 to NOE-039	Engg Mathematics III/ Science Based Elective	3	1	0	30	20	50	100	150	4
2	NCE-301	Fluid Mechanics	3	1	0	30	20	50	100	150	4
3	NEN-301	Environmental Chemistry and Microbiology	3	1	0	30	20	50	100	150	4
4	NEN-302	Environmental Engineering Process	3	1	0	30	20	50	100	150	4
5	NEN-303	Principles of Environmental Science & Technology	2	1	0	15	10	25	50	75	3
6	NHU-301/ NHU-302	Industrial Psychology / Industrial Sociology	2	0	0	15	10	25	50	75	2
	AUC-001/ AUC-002	*Human Value & Professional Ethics/Cyber Security*	2	0	0	15	10	25	50	75*	
Practicals											
7	NCE-351	Fluid Mechanics Lab	0	0	3	10	10	20	30	50	1
8	NEN-351	Microbiology Lab	0	0	2	10	10	20	30	50	1
9	NEN-352	Environmental Sanitation Lab	0	0	2	10	10	20	30	50	1
10	NCE-354	Building Planning & Drawing Lab	0	0	3	10	10	20	30	50	1
11	NGP-301	GP						50		50	
		Total	18	5	10					1000	25

The details of Science Based Electives are to be provided by The Boards of Studies of Science Subjects; these are common to all branches.

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

Study and Evaluation Scheme

B. Tech Environmental Engineering
[Effective from Session 2014-15]
Second Year, Semester IV

S. No.	Subject Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CA	TA	Total			
Theory Subject											
1	NOE-041 to NOE-049/ NAS-401	Science Based Elective / Engg Mathematics-III	3	1	0	30	20	50	100	150	4
2	NCE-402	Geoinformatics	3	1	0	30	20	50	100	150	4
3	NEN -401	Water Supply and Treatment Engineering	3	1	0	30	20	50	100	150	4
4	NEN- 402	Air Pollution and Control Engineering	3	1	0	30	20	50	100	150	4
5	NEN-403	Solid Waste Management	2	1	0	15	10	25	50	75	3
6	NHU-402/ NHU-401	Industrial Sociology / Industrial Psychology	2	0	0	15	10	25	50	75	2
	AUC-002/ AUC-001	*Cyber Security/Human Value & Professional Ethics*	2	0	0	15	10	25	50	75*	
Practicals											
7	NCE-452	Geoinformatics Lab	0	0	3	10	10	20	30	50	1
8	NEN-451	Water Supply & Treatment Lab	0	0	3	10	10	20	30	50	1
9	NEN-452	Solid Waste Management Lab	0	0	2	10	10	20	30	50	1
10	NEN-453	Air Pollution Control Engineering Lab	0	0	2	10	10	20	30	50	1
11	NGP-401	GP						50		50	
		Total	18	5	10					1000	25

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NCE 301 FLUID MECHANICS

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Unit - I

Fluid and continuum, Physical properties of fluids, Rheology of fluids.

Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance,

Unit - III

Potential Flow: source, sink, doublet and half-body.

Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.

Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies.

Unit - IV

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

Unit - V

Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

Introduction to compressible flow

References :

1. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley &Sons Pvt Ltd,
2. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
3. White,F.M. "Fluid Mechanics" TMH, New Delhi.
4. Munsen et al ,"Fundamental of Fluid Mechanics" Wiley Newyork Ltd
5. Garde, R.J., " Fluid Mechanics", SciTech Publications Pvt. Ltd
6. I.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student, Education

NEN 301: Environmental Chemistry and Microbiology

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3 1 0

Unit I:
Introduction to environmental chemistry: concept and scope of environmental chemistry, components of environment, natural cycles of matter in the environment.

Introduction to microbiology: Concept and scope of microbiology, kinds of microorganisms, major characteristics and the role of microorganisms, microorganisms in nature.

Unit II:
Chemistry of water and waste water: Hydrological cycle, structure of water molecule, water as a solvent principles of equilibrium chemistry, pH, oxidation - reduction and the applications of principles of chemistry for solving Environmental Engineering Problems.

Unit III:
Chemistry of the air environment: Chemistry of the atmosphere, combustion related air pollution, global environmental problems - chemistry of CFC, ozone depletion, greenhouse effect, acid rain, La Nino etc. Chemistry of pollution due to detergents, pesticides, polymers, trace organics, metals, petroleum and radioactive compounds.

Unit IV:
Environmental Microbiology: Basic principles of microbial transformation of organic matter, biodegradation, acclimatization of wastes and microbial inhibition mechanisms. Structure and function of cell constituents.

Unit V:
Pure and mixed cultures, Aerobic and anaerobic metabolism, microbial growth and dynamics, Microbial taxonomy, classification and morphological aspects of bacteria, fungi, protozoa, algae and other higher aquatic life forms. Bioassay tests for toxicity evaluation, Pathogens and indicator organisms. Role of microorganisms in water and waste water engineering. Microbiology applied to air pollution control (Bio scrubbers and bio-filters).

References:

1. A.K. De: Environmental Chemistry
2. Benefield, L.D, Judkins, J.F and Weand, B.L *Process Chemistry for Water and Waste water treatment*, Prientice-Hall, Inc. Eaglewood Cliffs, New Jersey, 1982.
3. Krueger and Johansson: Microbiology
4. Larinzar – General Biochemistry
5. Manahan: Environmental Chemistry
6. McKinney: Microbiology for Sanitary Engineers
7. Pelczar, Chan, and Krieg: General Microbiology
8. Pelczar, M.J., Chan E.C.S. and Krieg, N.R. *Microbiology*, Tata McGraw Hill, New Delhi, 1993.
9. Sawyer, C.N., McCarty, P.L. and Parkin, G.F., *Chemistry for Environmental Engineering*, Tata McGraw-Hill, New Delhi, 2003.
10. Sawyer, McCarty, and Parkin: Chemistry for Environmental Engineering
11. Sharma: Microbiology
12. Tortora, Funke and Case: Microbiology

NEN 302: Environmental Engineering Process

L T P
3 1 0

UNIT I: Classification of Pollutants
Pollutants in water and wastewater – characteristics, Standards for performance Significance of physico-chemical treatment – Selection criteria-types of reactor- reactor selection-batch-continuous type-kinetics

UNIT II: Physical Treatment Principles
Principles of Screening – Mixing, Equalization – Sedimentation – Filtration – Modeling, back washing – Evaporation – Incineration – gas transfer – mass transfer coefficient, Adsorption – Isotherms – Principles, kinetics, regeneration membrane separation, Reverse Osmosis, nano filtration, ultra filtration and hyper filtration electrodialysis, distillation – stripping and crystallization – Recent Advances.

UNIT III: Chemical Treatment Principles
Principles of Chemical treatment – Coagulation flocculation – Precipitation – flotation solidification and stabilization – Disinfection, Ion exchange, Electrolytic methods, Solvent extraction – advanced oxidation /reduction – Recent Trends

UNIT IV: Biological Treatment Principles
Objectives of biological treatment – significance – aerobic and anaerobic treatment kinetics of biological growth – Factors affecting growth – attached and suspended growth Determination of Kinetic coefficients for organics removal – Biodegradability assessment -selection of process reactors- batch-continuous type-kinetics

UNIT V: Sludge Treatment and Disposal
Design of sludge management facilities, sludge thickening, sludge digestion, biogas generation, sludge dewatering (mechanical and gravity) Layout PID hydraulics profile – upgrading existing plants – ultimate residue disposal – recent advances.

References:

1. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw Hill, New Delhi, 2003.
2. Qasim, S.R., Motley, E.M. and Zhu.G. Water works Engineering – Planning, Design and Operation, Prentice Hall, New Delhi, 2002.
3. Lee, C.C. and Shun dar Lin, Handbook of Environmental Engineering Calculations, Mc Graw Hill, New York, 1999.
4. Hendricks, D. ‘Water Treatment Unit Processes – Physical and Chemical’ CRC Press, New York 2006

NEN 303: Principles of Environmental Science & Technology

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2 1 0

UNIT I
Introduction: Structure of Environment – interaction between biological and chemical components – Law of Mass Action – Chemical equilibria – Chemical kinetics – Colloidal Chemistry – catalysis and Photocatalysis – Corrosion and its control.

UNIT II
Biological Systems: Plants – Animals – distribution – interaction – biomass – classification – salient features – nutrients and microorganisms – environmental factors.

Microbiology of Environment: Microbiology of water – soil – air. Indicator organisms, - coliforms – MPN index – M.F. technique – Biological indices. Biomonitoring methods – Eutrophication. Biological treatment of wastewater – bacterial reductions. Algae in water supply systems – problems and control. Macrophytes in water bodies – role – control.

UNIT III
Chemistry of Aquatics: Common organic reactions – Enzymes and factors influencing enzymic reactions – Pesticides and syndets – Transformation and degradation of pollutants.

UNIT IV
Chemistry of Atmosphere: Structure of the atmosphere – Photochemistry of the atmosphere – ozone layer depletion – Acid rain – Greenhouse gases and global warming.

References:
1. Biswarup Mukherjee, Environmental Biology, Tata McGraw Hill Publishing Company
2. Limited, New Delhi, 1997.
3. Manohaan, S.E., Environmental Science and Technology, Lewis Publication, New York,
4. 1997.
5. Sawyer, C.N., McCarty, P.L. and Parkin, G.F. Chemistry for Environmental Engineers, 4th Edition, McGraw Hill, New Delhi, 1994.
6. De, A.K. Environmental Chemistry, New Age International Limited, New Delhi, 1995

NCE 351 FLUID MECHANICS LAB

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Note: Ensure to conduct at least 10 experiments from the list:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. To draw a flow-net using Electrical Analogy Method.
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement
13. To determine the head loss for a sudden Contraction.

NEN 351: Microbiology Lab

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1. Use of microscope: Bacterial morphology and staining methods.
2. Biological examination of water: Algae, bacteria and Protozoa.
3. Quantitative plating method.
4. Bacterial water quality: Measuring quality of water by using coli form organisms (MPN method and membrane filter).
5. Indicator and Indices: Fecal streptococci, anaerobic bacteria
6. Estimation of sugars, proteins, lipids.
7. Biochemical activities of bacteria: hydrolysis of polysaccharides,
8. Determination of Biodiversity index.

Reference:

Sirockin and Cullimore: Practical Microbiology

NEN 352: Environmental Sanitation Lab

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1. Study of Storm Water Collection practices in your city.
2. Study of Sewage Collection practices in your city.
3. Study of rain water harvesting practices in your city.
4. Study on Constructions of Sewers, Joints, Manhole and other Sewer Appurtenances by site visit.
5. Layout of Sewer Lines using AUTOCAD, Planning of Sewerage System.
6. Study of sanitation in rural areas: visit to nearby village.

NCE-352 BUILDING MATERIALSLAB **LTP**
003

Testing of various properties of following as per BIS specifications

I.**Cement**

1.Normal Consistency of cement.
2.Initial & final setting time of cement
3.Compressive strength of cement
4.Finenessofcementbyair permeability and Le-chatalier's apparatus.
5.Soundness of cement.
6.Tensilestrength

II. **Coarse Aggregate**

1.Crushing value of aggregate
2.Impactvalue of aggregate
3.water absorption of aggregate
4.SieveAnalysis of Aggregate
5.Specific gravity &bulk density
6.Grading of aggregates.

III **FineAggregate** :

1.Sieveanalysisofsand
2.Silt content of sand
3.Bulkingofsand

IV **Cement concrete**: Workability tests, compressive strength, Tensile strength

V **Reinforcing Steel :**Tensile and yield strength, Percentage elongation

VI Non destructive testing on concrete

VII Bricks:

1.Waterabsorption.
2.Dimension Tolerances
1Compressive strength
4.Efflorescence

NEN 401: Water Supply and Treatment Engineering

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3 1 0

Unit-I
Characteristics of water: Physical, chemical and biological standards. Theory, Operation and design of aeration system, sedimentation, coagulation, and clariflocculation. Design of clariflocculator

Unit-II
Filtration: Slow and rapid gravity filter, multi-media filters and pressure filters. Design of slow sand filter and rapid sand filter. Disinfection: theory and application of chlorine. Miscellaneous methods of water treatment- removal of iron and manganese, hardness, fluorides, colour, taste and odour, dissolved metals and gases.

Unit-III
Adsorption, ion-exchange, membrane processes. Operation and Maintenance of water treatment plants, Industrial water treatment.

Unit-IV
Water Supply Engineering: Water demand, design period, population forecasting, sources of water; hydrological concepts, ground-water and its development.

Unit-V
Conveyance of water; pipe materials, corrosion, laying of pipes, pipe appurtenances, pumps for water supply, distribution system, planning of water supply projects. Design of water distribution network. Rural water supply distribution system.

References:

1. Fair, and Geyer: Water and Wastewater Engineering, Vol-I and II, John Wiley and sons, New York.
2. Steel and McGhee: Water Supply and Sewerage.
3. Peavy, Rowe and Tchobanoglous: Environmental Engineering
4. Hammer and Hammer, Jr.: Water and Wastewater Technology.
5. Garg, SK: Water Supply Engineering (Environmental Engineering Vol.-I)
6. Raju: Water Supply and Wastewater Engineering
7. Kshirsagar: Water Supply and Treatment
8. Punmia: Water Supply and Wastewater Engineering
9. Birdie: Water Supply and Sanitary Engineering

NEN 402: Air Pollution and Control Engineering

L T P
3 1 0

Unit I:
Air pollution: composition and structure of atmosphere, global implications of air pollution. classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants.

Unit II:
Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

Unit III:
Ambient air quality and standards, air sampling and measurements; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Design of gravitational settling chamber, cyclone seperater, fabric filter, electrostatic precipitator.

Unit IV:
Introduction to air pollution control, control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

Unit V:
Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

References:
1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control

NEN 403: Solid Waste Management

L T P
2 1 0

Unit-1
Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal.

Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. **Storage:** movable bins, fixed bins. **Collection:** home to home collection, community bin system. Theory and design of hauled container system, stationary container system.

Unit-2
Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments.

Unit-3:
Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate.

Unit-4:
Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system, Electronic waste and Biomedical waste. Overview of solid waste management practices in India.

References:
1. Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill, New York
2. Solid Waste Engineering, Principle & Management issues by Ven Te Chow
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt. of India.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Land fills, Narosa Publishers, Delhi.
7. Waste Management “Asian and Pacific Center for Transfer of Technology (N.D.) India”, September 1993.

NCE 402 GEOINFORMATICS

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3 1 0

Unit - I
Aerial Photographs- Basic terms & Definitions, scales, relief displacements, Flight Planning, Stereoscopy, Characteristics of photographic images, Fundamentals of aerial photo-interpretation, Introduction to Digital Photogrammetry.

Unit - II
Remote Sensing: Physics of remote sensing, Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC

Unit - III
Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing

Unit - IV
Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications

Unit - V
Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate sytem and map projection, Static, Kinematic and Differential GPS, GPS Applications

References
1. A M Chandra : Higher Surveying
2. B C Punamia : Higher Surveying
3. T M Lillesand et al: Remote Sensing & Image Interpretation
4. B. Bhatta: Remote Sensing & GIS
5. M Anjireddy : Remote Sensing & GIS , BS Publications
6. A. E Rabbany: Introduction to GPS
7. N K Agarwal : Essentials of GPS , Spatial Networks: Hyderabad.

NCE 452 GEOINFORMATICS LAB

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0 0 3

1. Demonstration and working on Electronic Total Station. Measurement of distances, horizontal & vertical angles and coordinates.
2. Measurement of area of a land parcel using Total Station.
3. To layout a precise traverse in a given area and to compute the adjusted coordinates of survey stations.
4. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs.
5. Visual Interpretation of standard FCC (False colour composite).
6. Digitization of physical features on a map/image using GIS software.
7. Coordinates measurement using GPS.

NEN 451: Water Supply and Treatment Lab

L T P
0 0 3

1. Sampling Techniques
2. Determination of pH, conductivity.
3. Determination of colour, turbidity.
4. Determination of total solids, total dissolved solids, total suspended solids and volatile solids.
5. Determination of hardness, chloride.
6. Determination of alkalinity, acidity.
7. Determination of iron, sulphate.
8. Determination of fluoride, nitrate.
9. Determination of sulphate.
10. Determination of fluoride.
11. Jar test for coagulation studies.
12. Application of laboratory and pilot plant scale units for evaluation of design criteria of:
    a) Settling analysis studies.
    b) Water treatment by slow sand filter / rapid gravity filter.

References:

1. Sawyer, McCarty and Parkin: Chemistry for Environmental Engineering
2. Mathur: Water and Wastewater Testing
3. Standard Methods for the Examination of Water and Wastewater, A.P.H.A., New York.

NEN 452: Solid Waste Management Lab

L T P
0 0 2

1. Sample preparation and sampling techniques.
2. Coning and quartering method.
3. Profile sampling of municipal solid waste.
4. Analysis of solid waste/sludge for moisture content.
5. Analysis of solid waste /sludge for particle size.
6. Analysis of solid waste/sludge for calorific value.
7. Determination of N in the sample.

ENV 453: Air Pollution Control Engineering Lab

L T P
0 0 2

1. Stack monitoring.
2. Ambient air monitoring for PM_{10}, SO_2 and NO_2.
3. Measurement of meteorological parameters (wind velocity, wind direction, humidity, temperature, solar insolation, rainfall) and drawing wind rose diagram.
4. Determination of HC and CO.
5. Determination of O_3.
6. Laboratory scale study on few air pollution control devices.

References:

1. W.H.O.: Selected Methods of Measuring Air Pollutants.
2. Pandey and Carney: Environmental Engineering