ANNA UNIVERSITY, CHENNAI

REGULATIONS 2009

CURRICULUM

M.E. ENVIRONMENTAL ENGINEERING

SEMESTER I

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	**MA9318**	Applied Statistics and Probability	4	0	0	4
2	**EN9311**	Environmental Chemistry	3	0	0	3
3	**EN9312**	Environmental Microbiology	3	0	0	3
4	**EN9313**	Air Pollution and Control	3	0	0	3
5	**EN9314**	Water and Sewage Conveyance	3	0	0	3
Practical						
6	**EN9317**	Environmental Engineering Laboratory	0	0	4	2
					Total	**18**

MA9318 APPLIED STATISTICS AND PROBABILITY

L T P C
4 0 0 4

UNIT I EMPIRICIAL STATISTICS 8

Measures of central tendency, dispersion, skewness and kurtosis – Principle of least squares – Correlation and regression – Rank correlation.

UNIT II SAMPLING DISTRIBUTIONS AND ESTIMATION 8

Sampling distributions – Point and interval estimates for population proportions, mean and variance – Maximum likelihood estimate method – Method of moments.

UNIT III TESTING OF HYPOTHESIS 9

Basic definitions of statistical hypothesis – Tests based on Normal, t, Chi-square and F distributions – Analysis of variance – One way and Two way Classifications.

UNIT IV DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomised block design – Latin square design – 2^2 factorial design.

UNIT V PROBABILITY AND RANDOM VARIABLES 11

Probability – Random Variables – Moments – Standard Distributions – Moment Generating Function – Functions of random variables – Two dimensional random variables – Multiple and partial correlation and Regression.

L: 45 T: 15 Total: 60

REFERENCES

1. Brethouex, P.U., "Statistics for Environmental Engineers", Lewis Publ./, 1994.
2. Johnson, R.J. "Miller and Freund's Probability and Statistical for Engineers" 6th Edition, Prentice – Hall of India, Private Ltd., 2002.
3. Ang, A.H.S. and Tang W.H., "Probability concepts in Engineering Planning and Design" – Basic principles Vol. John Wiley and Sons, Inc. 1975.
4. Gupta, S.C. and Kapoor, V.K. "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2001.
5. Taha, H.A., "Operations Research: An Introduction", Seventh Edition, Pearson Education Edition, 2002.

EN9311 ENVIRONMENTAL CHEMISTRY

L T P C
3 0 0 3

UNIT I FUNDAMENTALS 15

Colloids – Redox potentials – Partition co-efficient – Been – Lambert's Law – Limitations – UV visible spectroscopy – Basic principles – Application – Atomic absorption spectroscopy – Principles – Applications Gas chromatograph – Principles and applications – Principles of green chemistry – Error analysis of environmental data.

UNIT II DEGRADATION 8

Transport and transformation of chemicals – DO, BOD and COD – Photo catalysis – Degradation of food stuffs, detergents, pesticides and hydrocarbons.

UNIT III AQUATIC CHEMISTRY 7

Metals, complex formation, oxidation and reduction and sorption – E^h – p^H diagrams – chemical speciation – QSAR – Risk evaluation of chemicals.

UNIT IV ATMOSPHERIC CHEMISTRY 8

Regions of atmosphere – Chemical and photochemical reactions – Photochemical smog, ozone layer depletion – Green house gases and global warming – Acid rain.

UNIT V SOIL CHEMISTRY 7

Soil properties, clay minerals – Acid-base and ion-exchange reactions in soil – Salt affected soil and its remediation.

Total: 45

REFERENCES

1. C.N. Sawyer, P.L. MacCarty and G.F. Parkin, "Chemistry for Environmental Engineering and Science", 5th Edition, Tata McGraw-Hill, , 2003.
2. G.W. Vanloon and S.J. Duffy "Environmental Chemistry – a Global Perspective", Oxford University Press, 2000.
3. Connell, D.W., "Basic concepts of Environmental Chemistry", Lewis publishers, 1997.
4. Colin Baird, "Environmental Chemistry", Freeman and Company, 1997.
5. Manahan, S.E., "Environmental Chemistry", 6th Edition, Lewis Publishers, 1994.

EN9312 ENVIRONMENTAL MICROBIOLOGY

L T P C
3 0 0 3

UNIT I INTRODUCTION 5

Classification of microorganisms—prokaryotic, eukaryotic, structure, characteristics, nucleic acids – DNA, RNA, replication. Culturing of microorganisms, Recombinant DNA technology.

UNIT II MICROBIOLOGY OF ENVIRONMENT 10

Distribution of microorganisms—Water, Air and Soil, Indicator organisms, coliforms—fecal coliforms, E. coli, Streptococcus, Clostridium, Significance in water. Algae in water supplies—problems and control. Concentration and detection of virus, Transmissible diseases.

UNIT III METABOLISM OF MICROORGANISMS 10

Nutrition and metabolism in microorganisms, growth phases, carbohydrate, protein, lipid metabolism – Aerobic and anaerobic-respiration, fermentation, glycolysis, Kreb's cycle, hexose monophosphate pathway, electron transport system, oxidative phosphorylation, environmental factors, enzymes, Bioenergetics.

UNIT IV ROLE OF MICROORGANISMS IN WASTEWATER TREATMENT 10

Microbiology of biological treatment processes—aerobic and anaerobic, Biodegradation of toxic pollutants—mechanism – □-oxidation, □-oxidation, nitrification and denitrification, eutrophication.

UNIT V TOXICOLOGY 10

Ecotoxicology—toxicants and toxicity, factors influencing toxicity, effects—acute, chronic, concentration response relationships, test organisms, toxicity testing, bioconcentration, bioaccumulation, biomagnification, bioassay, biomonitoring.

Total: 45

REFERENCES

1. Maier, R.M., Pepper, I.L. and Gerba, C.P., "Environmental Microbiology", Academic Press, 1999.
2. Tortora. G.J, B.R. Furke, and C.L. Case, "Microbiology-An Introduction" 4th Edition, Benjamin/Cummings Publications, 1992.
3. Frank C. Lu and Sam Kacew, "LU's "Basic Toxicology", Taylor and Francis, 4th Edition, 2002
4. Baker. K.H. and Herson, D.S., "Bioremediation", McGraw-Hill Inc., 1994.

EN9313 AIR POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 10

Air resource management system – Air quality management – Scales of air pollution problem – Sources and classification of pollutants and their effect on human health vegetation and property – Global implications of air pollution – Meteorology Fundamentals – Atmospheric stability – Micrometeorology – Atmospheric turbulence – Mechanical and thermal turbulence – Wind profiles – Atmospheric diffusion – Atmospheric diffusion theories – Steady-state atmospheric diffusion equation – Plume rise – Diffusion models – Software applications – Ambient air quality and emission standards – Air pollution indices – Indoor air pollutants – Models – Air quality sampling and monitoring.

UNIT II CONTROL OF PARTICULATE CONTAMINANTS 12

Settling chambers – Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Case Studies.

UNIT III CONTROL OF GASEOUS CONTAMINANTS 13

Absorption – Principles – Description of equipment-packed and plate columns – Design and performance equations – Adsorption – Principal adsorbents – Equipment descriptions – Design and performance equations – Condensation – Design and performance equation – Incineration – Equipment description – Design and performance equations – Biological air pollution control technologies – Bio-Scrubbers, Biofilters – Operational considerations – Process control and monitoring – Case studies.

UNIT IV EMERGING TRENDS 6

Process modification – Automobile air pollution and its control – Fuel modification – Mechanical particulate collectors – Entrainment separation – Internal combustion engines – Membrane process – Ultraviolet photolysis – High efficiency particulate air filters – Technical and economic feasibility of selected emerging technologies for air pollution control – Control of indoor air quality – Radio active pollution and its control.

UNIT V NOISE CONTROL 4

Noise Standards – Measurement – Modeling – Control and preventive measures.

Total: 45

REFERENCES

1. Lawrence K.Wang, Norman C Perelra, Yung-Tse Hung, "Air Pollution Control Engineering", 2004.
2. Noel de Nevers, "Air Pollution Control Engineering", McGraw-Hill, 1995.
3. David H.F Liu, Bela G.Liptak "Air Pollution", Lewis Publishers, 2000.
4. Anjaneyulu, Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd, 2002.

EN9314 WATER AND SEWAGE CONVEYANCE

L	T	P	C
3	0	0	3

UNIT I PRINCIPLES OF HYDRAULICS 10

Fluid properties; fluid flow – Continuity principle, energy principle and momentum principle – Frictional head loss in free and pressure flow, major and minor heads loss, formula for estimation of head loss – pumping of fluids – Selection of pumps – Flow measurement.

UNIT II WATER TRANSMISSION AND DISTRIBUTION 10

Planning factors – Water transmission main design – Pipe material – Economics – Water hammer analysis – Water distribution pipe networks – Methods for analysis and optimisation – Laying and maintenance, insitu lining – Appurtenances – Corrosion prevention – Minimization of water losses – Leak detection.

UNIT III WASTEWATER COLLECTION AND CONVEYANCE 10

Planning factors – Design of sanitary sewer – Partial flow in sewers – Economics of sewer design – Sewer appurtenances – Material, construction, inspection and maintenance of sewers – Design of sewer outfalls – Mixing conditions – Conveyance of corrosive wastewaters.

UNIT IV STORM WATER DRAINAGE 5

Planning – Run-off estimation – Rainfall data analysis – Storm water drain design – Rain water harvesting

UNIT V CASE STUDIES AND COMPUTER APPLICATIONS 10

Computer applications for water transmission – Water distribution and sewer design.

Total: 45

REFERENCES

1. Bajwa, G.S., "Practical Handbook on Public Health Engineering", Deep Publishers, 2003.
2. Anonymous, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, Government of India, 1999.
3. Anonymous, "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Government of India, 1993.
4. Hauser, B.A., "Practical Hydraulics Handbook", Lewis Publishers, 1991.

EN9317 **ENVIRONMENTAL ENGINEERING LABORATORY**

L T P C

0 0 4 2

ENVIRONMENTAL CHEMISTRY LABORATORY

1. PHYSICAL AND CHEMICAL ANALYSIS OF WATER 12

   pH, Conductivity, Turbidity, Solids, Chlorides, Sulphates, Alkalinity, Fluorides, Nitrate and heavy metals.

2. PHYSICAL AND CHEMICAL ANALYSIS OF WASTEWATER 8

   Phosphate, COD, BOD, Organic and ammonical nitrogen, Oil and grease.

3. AIR QUALITY ANALYSIS 6

   SPM, SO_2, CO, NO_x

4. SOIL ANALYSIS 4

   pH, Conductivity, Cation exchange capacity, Sodium Absorption ratio

ENVIRONMENTAL MICROBIOLOGY LABORATORY

1. Preparation of media, serial dilution and plating, Growth curve 6
2. Sampling of Microorganisms from air, water and soil, staining – simple and gram staining 6
3. Effect of pH, temperatures and nutrients on growth of bacteria 2
4. Bacteriological analysis of water Coliforms and streptococcus fecalis by -MPN and membrane filter techniques 10
5. Study of aquatic organisms – Algae, protozoa and fungi 6