School of Environmental & Earth Sciences
North Maharashtra University, Jalgaon

Grade 'B' (2.88)
NAAC Re-Accredited

SYLLABUS & COURSE STRUCTURE
M. Tech. (Environment Science & Technology)
W.e.f. 2015 - 2016

Course Structure
M. Tech. (Environnemental Sciences & Technology)

First Semester

Sub. Code	Paper	Teaching Scheme / Hrs. / Week	Exam Scheme	Marks		Total	Credit Point
				Internal	External		
MTE - 101	Water & Wastewater Management	03	03	40	60	100	03
MTE - 102	Environmental System Optimization & Modeling	03	03	40	60	100	03
MTE - 103	Modern Tools in Environmental Technology	03	03	40	60	100	03
MTE - 104	Instrumental Techniques in Environmental Analysais	03	03	40	60	100	03
MTE - 105	Biotechnological Applications for Environmental Protection	03	03	40	60	100	03
MTE - 106	Principales of Air & Noise Pollution Management	03	03	40	60	100	03
MTE – 107	Practical Course	08	03	40	60	100	03
Grand Total						**500**	**15**

Note: MTE: - 101, 102, & 107 are compulsory. Select any two papers out of MTE: - 103, 104, 105 & 106

Second Semester

Sub. Code	Paper	Teaching Scheme / Hrs. / Week	Exam Scheme	Marks		Total	Credit Point
				Internal	External		
MTE - 201	Industrial Pollution Control	03	03	40	60	100	03
MTE - 202	Environmental Impact Assessment & Audit	03	03	40	60	100	03
MTE - 203	Industrial Safety, Environmental Health and Disaster Management	03	03	40	60	100	03
MTE - 204	Solid & Hazardous Waste Management	03	03	40	60	100	03
MTE - 205	Environmental Geotechnology	03	03	40	60	100	03
MTE - 206	Natural Resource Management	03	03	40	60	100	03
MTE – 207	Practical Course	08	03	40	60	100	03
Grand Total						**500**	**15**

Note: MTE: - 201, 202, & 207 are compulsory. Select any two papers out of MTE: - 203, 204, 205 & 206

Third Semester

Sub. Code	Paper	Teaching Scheme / Hrs. / Week	Exam Scheme		Total	Credit Point
			Internal	External		
MTE - 301	Seminars & Industrial visits	----	100		100	05
MTE - 302	Project	-----	80	120	200	10
Grand Total						**15**

Fourth Semester

Sub. Code	Paper	Teaching Scheme / Hrs. / Week	Exam Scheme		Total	Credit Point
			Internal	External		
MTE - 401	Project	--	80	120	300	10
Grand Total						**15**

Scope of the Course

- Basically, this program provides an innovative, high-quality learning opportunity in Health, Safety & Environmental Engineering and Management.
- It's a professional degree that will enable the students to manage the safety needs of organizations in a variety of occupational environments with special focus on the industrial sector.
- Environmental Science & Technology has immense scope in India for professionals who are qualified in chemical, biological, thermal, radioactive or even mechanical engineering as environmental engineering is a diverse field and requires people from diverse background. Moreover, professionals from process engineering, environmental chemistry, water and sewage treatment, waste reduction management, pollution prevention, etc are required in large numbers.
- Job prospects for professionals with qualification in environmental engineering are bright at research centers, NGOs and various governmental departments (CPCB, MPCB, MMRDA, MoEF etc.) working towards environmental protection. Candidates with M.Tech in environmental engineering have opportunities to work for government built assessment committees which study and analyze the environmental risks involved in certain projects.
- The candidates having knowledge of the course are capable to build independent entrepreneurship establishments and consultancies in environmental science & technology sector

Eligibility Criteria

- Candidate for the admission to the M. Tech degree programme should have passed B.E. or B. Tech**.** Degree programme, OR M.Sc. Environment / Chemical / Biotechnology / Biomedical / Earth Sciences of an appropriate branch of study or an examination accepted by N.M.U., Jalgaon as equivalent there to.
- The sponsored candidates should satisfy the conditions regarding sponsorship that may be prescribed by N.M.U. from time to time.

Credit Structure and Examination Rules for M. Tech. (Full & Part Time)- Chemical Engg./ Polymer Tech., M. Tech. (Environmental Science & Tech.) and M. Tech. (VLSI Elect.) Courses

Requirement of CREDIT SYSTEM

1. In tune with the concepts and suggestions of the AICTE, UGC and NAAC, Banglore and technological advancements and societal needs and to make the teaching effective and meaningful, the University has adopted Cumulative Grade Point Average (CGPA) system for the following M.Tech. Courses being run in the campus on regular basis.

i. Chemical Engineering-
ii. Polymer Technology
iii. Environmental Science & Tech.
iv. VLSI

2. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination shall be duly notified before commencement of each semester every year by the School/ Department. The academic calendar and the examination schedule shall be independent for the Department / School running CGPA pattern. The External Examinations for all the terms shall be conducted at the end of the term (i. e. after 13 weeks of teaching sessions/ contact period).

3. Each School/ Department will constitute Departmental Course Committee headed by Course Coordinator. Paper Setting, and Assessment for External Examinations shall be carried out partially by the Department / School and partly Externally; the exact ratio of External /Internal Setting & Evaluation shall be decided by the individual Course Coordinator, and Head of the Department / Director of School. The appointment of Examiners shall be carried as per Maharashtra University norms.

4. If a student admitted to M.Tech. covered one or more than one course prescribed for M.Tech. At any stage during his / her qualifying Degree , He / She will get exemption for that course and earned credit point will be transferred.

5.The student of the M. Tech Course will have to attend the 80% of lectures, practical and any other term work as prescribed by the University. The conduct and behavior of the student must satisfy the Head of the Department / Director of the School.

6. The Head of the Department Director of the School will certify that the student has attended the course as prescribed and has conducted himself satisfactorily. In absence of such certificate, the student shall not be permitted to appear for the University Examination.

7. The student shall have to appear personally to all parts of the examination.

8. Student will be allowed to take admission in subsequent semester provided his/ her term is granted in previous semester. However, the Student will not be allowed to submit his/ her 4th Semester Major Project Thesis unless he clears all previous Semester Examinations.

The modalities and operational details of the credit system shall be as follows.

1. The credits shall be awarded in the terms of 1 credit for 1hr per week per semester teaching load of theory paper and one credit for 2 hours of practical, project, seminar, field work etc. of Master's courses being run in Schools / Departments. Thus the courses shall be awarded credits in the ratio of half of the total practical hours per week allotted to the course. Student s can be registered for minimum of 12 credits and maximum of 20 credits in one semester. However in one academic year he / she has to appear for minimum courses of 30 credits. Out of 60 credits student have to opt electives of 12 credits.
2. The weightage of the test (%) will be as follows on awarding the credits as approved by the Department / School course committee -

Term end examination (Major Examination)	60
Two Minor Tests	40
Total	100

The marks distribution for the courses, which are of variation in credits, shall be in the same ratio.

3. Two minor tests (20 marks of each) will be conducted by the subject teacher while Major Examination of 60 marks will be partly based on External Paper Setting/ Assessment as decided by Course Coordinator, and Head of the Department /Director of the School. Departmental

Internal Assessment Committee will coordinate Internal Examination Activity. It is mandatory to show the answer sheets of all tests to the students. The marks for each test will be displayed on the notice board within seven days of conducting the test. The first minor test will be conducted after 4 weeks from starting of the semester. There will be a flexibility in distribution in the internal marks on the basis of regularity, sincerity, punctuality of the student as per the requirement of the course and mode of conduct of internal examination.

Term End Major Examination: - The term end major examination for 60 marks per course would be held about two weeks after completion of teaching for the semester. Each theory paper of 60 marks shall be of three hours duration and each theory paper of 30 marks shall be of 2 hours duration. Paper setting and assessment for a particular course would be the responsibility of the course Coordinator, and would be conducted partly by appointment of External Examiners and rest through Department/ School. These activities, including preparation of the result-sheets for the students, would be coordinated by the Department Assessment Committee comprising Course Coordinator and HOD/ Director. On the basis of marks obtained, grade points will be given to the students which will be approved by the Departmental Course Committee followed by submission to the Controller of Examination.

4. **Practical Courses**: Practical courses will be evaluated on the basis of each practical performed by student. Internal Marks (40%) for practical will be based on average assessment of at least 10 practicals per course by the faculty conducting the practical in consultation with the Course in-charge. Major Examination of 60 marks will be partly based on External Assessment as decided by Course Coordinator, and Head of the Department / School. The total marks allotted will be recalculated and converted in to credit grade point.

5. Seminar/ Field Work Components/ Industrial Training:

Five credits based on each Seminar/field work component/ Industrial Training will constitute the compulsory part. There will be a continuous evaluation of the seminar, preparation of the seminar and/or fieldwork. The evaluation will be based on following four heads:

Heads	Marks	Evaluating Authority
Performance of the student in the Collection of reference material for seminar/in the field	20	By faculty members involved in conducting seminar/tour
Punctuality, enthusiasm, and aptitude of students in preparing seminar/completing the report	20	By faculty
Performance in Seminar/Tour report	40	By External Referee
Viva-voce	20	By External Referee

The marks out of 100 will be computed to 5 credits for the purpose of grades.

1. **Research Project:**

The output of Major Research Project must result in Publications/ presentations. At least one research paper be published/ presented in National or International Journal/ Conferences. The student shall submit first Synopsis of Major Project to the Department followed by submission of neatly bound and typed Thesis within 3 Weeks from the date of submission of Synopsis. The findings of Research Project will be examined by External Referee (For the purpose of Appointment of Referee, Panel of Eminent Experts in relevant field will be constituted on the similar lines of appointment of M. Phil./ Ph. D. Referee) and Project Guide.

Grade Point Calculations

(i) Grades - Marks for each course would be converted to grades as shown in

Table 1: Conversion of marks to grades in credit system

Qualification	Grade	Points	% points of max. Marks
Outstanding	O	10	90 & Above
Excellent	E	9	80-89
Very Good	A	8	65 - 79
Good	B	7	55 - 64
Satisfactory	C	6	45-54
Fair	D	5	40-44
Fail	F	0	Less than 40

To judge the overall performance one considers cumulative Grade Point Average as the criterion. CGPA Calculation is as illustrated below:

CGPA Calculation System

SGPA:	Semester grade point average
CGPA:	Cumulative grade point average
Point:	(a) Integer average of each letter grade
Credit:	(b) Integer signifying the relative emphasis of Individual Course item(s) in a semester as indicated by the course structure and syllabus.
Credit Point:	(b) times (a) for each course item
Credit Index:	CREDIT POINT of course items in semester
GRADE POINT:	CREDIT INDEX divided by CREDITS
AVERAGE SGPA:	CREDIT INDEX for a semester divided by CREDITS in a Semester
CGPA:	CREDIT INDEX of all previous semesters divided by CREDITS of all previous semesters.

i) For the purpose of Passing in individual papers, the student must secure at least 40 % in University term examination and at least D grade (40%) on the basis of total marks obtained in Internal and External examinations of individual papers. Student must appear in all examinations.

ii) A student who passes the minor tests (≥ 40%) but fails in Term End Examination i.e.(< 40%) the student shall be given F grade. Student with F grade in a course would be granted credit for that course but not the grade for that course and shall have to clear the concerned course within 1.5 year from appearing for first time in the concerned paper. However M. Tech. Course must completed within four years period of time.

iii) For improvement of the grade s student can opt more electives

iv) The Student will not be allowed to submit his/ her Major Project Thesis unless he clears all previous Semester Examinations i.e. grades better than D.

7. <u>Final Result</u>: For the final result of a student, Cumulative grade point average (CGPA) based on total earned credits vis-à-vis total earned grade points shall be calculated. The (CGPA) shall be calculated as-

$$\text{SGPA} = \frac{\text{Sum of the earned grade points during semester}}{\text{Sum of credits of semester}}$$

$$\text{CGPA} = \frac{\text{Sum of total earned grade points}}{\text{Sum of total credits}}$$

The final grade earned shall be as per Table 2 below.

Qualification	**Final Grades**	**CGPA**
Outstanding	O	9.0 – 10
Excellent	E	8.0 – 8.9
Very Good	A	6.5 – 7.9
Good	B	5.5 – 6.4
Satisfactory	C	4.5 – 5.4
Fair	D	4.0 – 4.4
Fair	F	0 – 4.0

i. For overall passing CGPA of 5.5 is concerned satisfactory. The student thus will be declared eligible for award of M. Tech. degree if only the student receive at least CGPA of 5.5

ii. If the student is unable to secure at least CGPA 5.5, then the student will have to appear in all courses / papers in which student has secured D & F grades.

COURSE STRUCTURE
M. Tech (Environment Science & Technology)

Sr. No.	Subject Code	Course structure
Semester I		
1	**MTE-101**	Water & Wastewater Management
2	**MTE-102**	Environmental System Optimization & Modeling
3	**MTE-103**	Modern Tools in Environmental Technology
4	**MTE-104**	Instrumental Techniques in Environmental Analysis
5	**MTE-105**	Biotechnological Applications for Environmental Protection
6	**MTE-106**	Principales of Air & Noise Pollution Management
7	**MTE-107**	Practical Course
Semester II		
8	**MTE-201**	Industrial Pollution Control
9	**MTE-202**	Environmental Impact Assessment & Audit
10	**MTE-203**	Industrial Safety, Environmental Health and Disaster Management
11	**MTE-204**	Solid & Hazardous Waste Management
12	**MTE-205**	Environmental Geotechnology
13	**MTE-206**	Natural Resource Management
14	**MTE-207**	Practical Course
Semester III		
15	**MTE-301**	Seminars & Industrial visits
16	**MTE-302**	Project
Semester IV		
17	**MTE-401**	Project work

SEMESTER I

MTE – 101 WATER& WASTEWATER MANAGEMENT

Unit I: Water Quality and Parameters:

Water Quality-Physical, chemical and biological parameters of water- Water Quality requirement - Potable water standards -Wastewater Effluent standards -Water quality indices. Water purification systems in natural systems-Physical processes-chemical processes and biological processes-Primary, Secondary and tertiary treatment-Unit operations-unit processes. Mixing, Clarification - Sedimentation; Types; Aeration and gas transfer – Coagulation andflocculation, coagulation processes - stability of colloids - destabilization of colloids-transport of colloidal particles, Clariflocculation.

Unit II: Consequences of Water Pollution:

Biological uptake of pollutants and their effects on land, vegetation, animals and human health, bio-deterioration, bioaccumulation, bio-magnification and eutrophication, infectious microbial agents in water system and their consequences on human health.

Unit III: Sewage Treatment

Chemical precipitation, Principle of biological treatment-derivation of bacterial growth kinetics used in designing of wastewater treatment plant. Process design and operation of Activated sludge process and its modification. Bulking and rising sludge. Wastewater treatment for small communities – Oxidation ditch, extended aeration system, SBR; Process design and operation of mechanically aerated lagoon and Waste stabilization pond system.. Sewage disposal in isolated un-sewered areas–septic tank, cesspools and their effluent disposal methods.

Unit IV: Design and Operation

Sewage characteristics, Quantity & Quality, flow rate, treatment flow –sheets. Sewage treatment process, reactor type, hydraulic characteristics, C-diagram. Preliminary treatment-design and operation of screening and grit chamber. Sedimentation, design and operation PST; Design and operation of biological nitrification – de-nitrification system; luxurious phosphorus uptake. Aerobic attached growth process –Process design and operation of trickling filter, RBC, Bio-filter

Unit V: Process Selection and System Synthesis:

Waste waters, industrial wastewaters, interaction of system components, mixing waste waters and regional plants,Concept of common effluent treatment plant (CETP)system economics, water treatment systems, experimental studies.

Books and References

1. Wastewater Engineering: Treatment, disposal, Reuse – Metcalf & Eddy Inc.4th ed. TMGHl, New Delhi, 2003.
2. Environmental Engineering- Peavy, HS, Donald RR & G. Tchobanoglous, MGH Int. Ed. New York, 1985.
3. Wastewater Treatment for Pollution Control – Soli J Arceivala, Tata McGraw Hill, 2nd ed.1998
4. Wastewater Treatment Plants: Planning, Design and Operation- S.R..Qasim, Holt, Rinehart & Winston, NY, 1985
5. Industrial Water Pollution Control –WW Eckenfelder, Jr., McGraw –Hill , 2nd Edition, NY 1989.

MTE 102 - ENVIRONMENTAL SYSTEM OPTIMIZATION AND MODELING

Unit I: Systems Approach Concept & Analysis

Model Classification, Terminology of Models, Model Building, Fundamental of Modeling, Transport Law, Chemical Equilibrium, Phase Equilibrium Rooth's Law, Relative Velocity and Chemical Kinetics

Unit II: Process Modeling

Linear equilibrium system, Batch Reactor, pH system, Planning Models, Municipal solid waste management, Integrated Solid waste Management, Reuse and Recovery in paper, Palstic, glass and aluminum waste

Unit III: Water Modeling

Modeling of wastewater management systems. Modeling of pesticide management; Modeling of Modeling of municipal wastewater treatment, Model formulization and their solution, Numerical Techniques of Linear equations, Matrix inversion method, Gasses elimination and gas sidal method.

UNIT IV: Programming Model

Silent feature of optimizations, Linear programming problem, Simplex method, Prinicpales of problem in dual problem, Graphical Method, Principles related to graphical method – Optimum solution and their analysis (Minimization & Maximization) At least one problem of each method along with optimum solution.

Unit V: Air Dispersion & Equations of Continuity

Equations of continuity for rectangular, cylindrical, spherical. Derivation for rectangular co-ordinate. Numericals based on equation of continuity. Pollutant standard index criteria, toxic air pollutants, Motor vehicle emission, the point source Gaussian Plume models, Transportation Models.

Books and References

1. Handbook of Environmental and Ecological Modeling, Halling-Sorensen B., Nielsen S.N. and Jorgensen S.E., Lewis Publishers Inc., 1995.
2. Fundamentals of Atmospheric Modeling, Jacobson Mark Z., Kluer Academic Press, 2002.
3. An Introduction to Water Quality Modeling, James A. (Ed), (2nd Ed.), 1992.
4. Techniques for Environmental System Analysis - R.H.Pantell Wiley, NY, 2001.
5. System Analysis and Design – RJ Aguilar, Prentice Hall, Englewood Cliffs, N.J., 1993.
6. Numerical Methods and Analysis- Dr. S. K. Rathore.
7. Transport Phenomenon – Bird.

MTE - 103 MODERN TOOLS IN ENVIRONMENTAL TECHNOLOGY

UNIT I: Fundamentals of Remote Sensing

Introduction, Types, Application and Importance of Remote Sensing; Physics of Remote Sensing; The Electromagnetic spectrum; Spectral Reflectance Curves; Spectral Signatures; Resolution.

UNIT II: Satellite Remote Sensing

Remote Sensing Platforms: Gound, airborne and satellite based platforms; Some important Remote Sensing Satellites. Sensors: Passive and Active Sensors; Major Remote Sensing Sensors; Satellite band designations and principal applications; Colour/False Colour, Aerial Photography/Aerial Photo Interpretation.

UNIT III: Digital Image Processing and Image Interpretation

Digital Image Processing: Pixels and Digital Number; Digital Image Structure; Format of Remote Sensing Data; Image Processing functions: Image Restoration, Image Enhancement, Image Transformation, Image Classification and Analysis; Image Interpretation strategies.

UNIT IV: Geographic Information Systems (GIS) & GPS

Geographic Information System; Introduction; Preparation of thematic map from remote sensing data; Co-ordinate systems; GIS components; Hardware, software and infrastructures; GIS data types: Data input and Data Processing; DEM/DT, generation. Integration of GIS and Remote Sensing Application of Remote Sensing and GIS Water resources Urban Analysis Watershed Management Resources Information Systems. Global Positioning System an introduction.

UNIT V: Computer Applications

Basic concepts of computer, hardware, operating systems Application software in Environmental sciences: word processing, spreadsheets, graphics and data base, Introduction to web browsing software and search engines with special reference to online environmental monitoring.

Books and References

1. Aerial photographic interpretation, Principles and applications - D.R.Leuder.
2. Photogeology - Miller, J.C.
3. Manual of colour aerial photography -Ed. Smith, J.T.Jr.
4. Manual of photogrammetry - Ed: MorrieM.Thompson.
5. Manual of Remote sensing - Ed: Robert G Reeves.
6. Theory of pattern recognition and modern forecasting - V.Karpin and Wright Pattern.
7. Remote sensing in Geology - Parry S. Siegal& Alan. R.Gillespie
8. Manual of photographic interpretation - Ed: Colwell, R.N.
9. Principles of Remote Sensing - Patel Singh; SP publication
10. Digital Remote Sensing - Pritivish Nag M Kudrat ; Concept publication
11. Principles of GIS for land and resources assessment, Burrough, P.A., 1986, Oxford.
12. Geographical information systems Vol 1 & 2. Edited by: Paul A.Longley, Michael F. Goodchild, David J. Maguire & David W.Rhind.
13. Geographical information systems and digital image processing – Muralikrishna1999. Allied Publication**.**

MTE – 104 INSTRUMENTAL TECHNIQUES IN ENVIRONMENTAL ANALYSIS:

Unit I: Treatment of Data in Quantitative Analysis

Accuracy, Precision, Standard deviation, Types of errors, Minimization of errors. Significant figures, Criteria for rejection of data, Principles of instrumentation.

Unit II: Spectrophotometric Methods

Principles, applications, advantages & limitations of the following Spectrophotometric methods: Colorimetry & Spectrophotometry, FTIR, NMR, Atomic absorption spectrophotometry, Flame photometry, Fluorimetry, Nephelometry and Turbidimetry, Inductively coupled plasma spectroscopy & Mass spectroscopy.

Unit III: Electrochemical Methods

Principles, applications, advantages & limitations of following electrochemical methods: Polarography, Pulse polarography, Ion-selective electrode oscilloscopic polarography, cyclic voltametry & anode stripping voltametry.

Unit IV: Chromatography

Principles, applications, advantages & limitations of following chromatographic methods: Adsorption, Partition, Column chromatography, Paper chromatography, thin layer chromatography, Gas chromatography, High Performance Liquid Chromatography (HPLC), Ion-chromatography & size exclusion chromatography.

Unit V: Physical and Biological Methods

Analytical methods in Biotechnology & bio-process control, Electrophoresis, X-ray crystallography, Bio-informatics tools, Bio-assay of pharmaceutical products, online & off line measurement systems, micro processor based control systems.

BOOKS & REFERENCES:

1. Instrumental Methods of analysis, Willard H H& Dean LL, John Willey, 1976.
2. Modern Methods of chemical analysis Recsok RL, & Shields LD, John Willey & sons, Inc 1990.
3. Instrumental Methods of chemical analysis, Ewing GW, McGrw Hill Book Company, Inc. 1975.
4. Fundamental of molecules spectroscophy. Banwell CN, McGraw Hill, NY, 1990.
5. Vogels textbook of Quantitative chemical analysis, Third Ed.

MTE – 105 BIOTECHNOLOGICAL APPLICATIONS FOR ENVIRONMENTAL PROTECTION

Unit I: Environmental Biotechnology: Basic Concept

Principles and concepts of environmental biotechnology – usefulness to mankind.

Unit II: Biotechnology in Pollution Control

Types of pollution, Methods for measurement of pollution, Methodology of environmental management, air pollution and its control through biotechnology. Water as a scare natural resource, need for water management, measurement of water pollution, waste water collection, waste water treatment – Physical, chemical and biological treatment processes. Solid waste management (composting, wormiculture and methane production)

Unit III: Microbial Technology for Waste Management

Degradation of high concentrated toxic pollutants, non-halogenated, halogenated petroleum hydrocarbons-metals. Mechanisms of detoxification-oxidation reactions, de-halogenation biotransformation of metals. Microbial cell/enzyme technology – adapted microorganisms – biological removal of nutrients microalgal biotechnology and applications in agriculture- role of extra cellular polymers.

Biotechnological remedies for environmental damages – decontamination of ground water systems subsurface environment – reclamation concepts – bioremediation. Production of proteins – biofertilizers. Biodegradation of solid wastes – physical, chemical and microbiological factors of composting – health risk – pathogens – odour management – technologies of commercial importance advances in biogas technology – case study.

Unit IV: Fermentation Biotechnology

Anaerobic digestion, anaerobic filters, Up-flow un-anaerobic sludge blanket reactors, treatment schemes for waste water of daiy, distillery, tannery, sugar, antibiotic industries.

Aerobic process, activated sludge, oxidation ditches, trickling filters, towers, rotating biological contractors, oxidation ponds.

Unit V: Biotechnology and Global Environmental Problems

Ozone depletion UV-B, green house effect and acid rain, their impact and biotechnology approaches for management.

Books and References

1. Wainwright, M, “An Introduction to Environmental Biotechnology “, 1999.
2. Martin, A.M., “Biological Degradation of Wastes “, Elsevier Appl. Science, New York, 1991.
3. Sayler, Gray S. Robert Fox and James W. “ Blackburn Environmental Biotechnology for Waste Treatment “, Plenum Press, New York 1991.
4. Bruce E. Rittmann, Eric Seagren, Brian A.Wrenn and Albert J. Valocchi, Chittaranjan Ray, Lutgarde Raskin, Insitu Bioremediation (2nd Ed.) Nayes Publ. U.S.A. 1994.
5. Old, R.W., and. Primrose, S.B., “Principles of Gene Manipulation (3rd Ed.) “, Blackwell Sci. Publ., Cambridge, 1985.

MTE – 106 PRINCIPALES OF AIR & NOISE POLLUTION MANAGEMENT

UNIT I: Sources of Air Pollution

Stationary and mobile, fugitive emissions, secondary pollutants; Effects of air pollution in regional and global scale, air pollution episodes; Emission factors inventory and predictive equations.

UNIT II: Atmospheric Meteorology

Wind profiles, turbulent diffusion, topographic effects, separated flows, temperature profiles in atmosphere, stability, inversions, and plume behavior.

UNIT III: Air Quality Monitoring

Objectives, time and space variability in air quality; air sampling design, analysis and interpretation of air pollution data, guidelines of network design in urban and rural areas.Stack monitoring. Air pollution standards and indices. Dispersion of air pollutants and modeling, Basic concepts, inversion layer and mixing height, atmospheric stability classes, theory and application of acoustic sounding (SODAR) technique. Boxmodel, The Gaussian dispersion model point, area and line sources. Prediction of effective stack height physics of plume rise, Holland's equation, Briggs equation, etc. modifications of Gaussian dispersion models; indoor air quality models. Air pollution control devices.

UNIT IV: Effects of Air Pollution and Air Monitoring Instruments

Human health, plants, animals and microbes, archeological monuments and aesthetics, Orsat apparatus, Respirable dust sampler and source monitors.

UNIT V: Noise Pollution

Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices.

Books and References

1. Environmental Engineering – Arcadio P. Sincero and Gregoria A. Sincero, Prentice Hall of India, 1999.
2. Environmental Pollution Control Engineering- CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
3. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987.
4. Handbook of Noise Measurement – APG Peterson & EE Gross PH, Englewood cliffs New Jersey, latest edition.
5. Air Pollution Control Equipment – H. Brauer and Y. B. G. Verma, Berlin Heidelberg, New York, latest edition.

MTE – 107 PRACTICAL COURSE ON ABOVE THEORY COURSES

1. Calibration and Standardization Techniques in the water and waste water quality analysis.
2. Study of Various components of Effluent Treatment Plant in accordance with effluent characteristics and parameters.
    a. Skimming tanks : Oil and Grease,
    b. Equalization and neutralization tanks: pH & Electrical Conductivity etc.
    c. Primary Settling tank: Total Solids and its various forms.
    d. Activated Sludge Processes (Aeration, Trickling filter, RBCs etc. (Dissolved Oxygen, Chemical Oxygen Demand and Biochemical Oxygen Demand)
3. Drinking Water Treatment :
    a. Alkalinity, Hardness Ca & Mg
    b. Chloride, Residual chloride, Chlorine Demand
    c. Sulfate, Nitrate and Phosphate
4. Soil Study :
    a. Soil sampling, description of the soil horizon, determination of soil pH, conductivity and salinity from soil samples
    b. Organic carbon and Organic Matter from soil samples (Walky- Black Method)
    c. Sodium and Potassium; CEC from soil samples
5. Remote Sensing and GIS Techniques
    a. Study of traditional maps
    b. Visual interpretation of earth's features from aerial photographs and satellite images
    c. Stereo-photo interpretation
    d. Photogrametric computation
    e. Preparation of thematic maps in GIS
    f. Operation of GPS
    g. Drawing flow charts for the computer programs required in solving environmental problems.

SEMESTER II
MTE 201 - INDUSTRIAL POLLUTION CONTROL

Unit I: Introduction

Industrial scenario – requirement of water for industries – Sources and types of industrial wastewater – Industrial wastewater disposal and environmental impacts – Reasons for treatment of industrial wastewater – Regulatory requirements – Industrial waste survey – Industrial wastewater generation rates, characterization and variables – Population equivalent – Toxicity of industrial effluents and Bioassay tests – Preventing and minimizing wastes at the source – Individual and Common Effluent Treatment Plants.

Unit II: Industrial Water Pollution Control and Treatment

Characteristics of different industrial wastewaters and their effects on environment. Standards related to industrial wastewater. Waste volume reduction, waste strength reduction, neutralization, equalization and proportioning. Industry specific wastewater treatment for chloro-alkali, electroplating, distillery, tannery, pulp and paper, fertilizer, etc. Treatment technology of coal washery and coke oven effluents. Acid mine drainage: occurrence, effects and treatment technologies. Equalization – Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal – Refractory organics separation by adsorption – Aerobic and anaerobic biological treatments. Chemical oxidation – Ozonization – Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange.

Unit III: Air Pollution Control System Design

Review of general principles of industrial air pollution control. Design and operation of gravity settling chambers. Design and operation of cyclones. Design and operation of wet dust scrubbers – column scrubbers, jet scrubbers, vortex scrubbers, rotating disc scrubbers, and venturi scrubbers. Design and operation of fabric filters. Design and operation of electrostatic precipitators design and operation of mist separators- baffled mist separators, pressure separators. Dust control and abatement measures in mines; role of green belts. Control devices for gaseous pollutants with special emphasis on adsorption, absorption, mass transfer, condensation, and combustion.

Unit IV: Noise Control Engineering

Noise pollution and management in Mines, Washeries, Power plants, Fertilizer plants, Cement plants, etc. health effects and control measures. Noise measurement techniques and analysis: Industrial Worksite, Noise prediction and modelling, noise impact assessment: Scultz Fractional Impact method; Value function curves. Noise abatement measures in industries - Sound absorption, Acoustic barrier, Vibration Isolation, Vibration damping, Muffling, Personal protector.

Unit V: Case Studies

Industrial manufacturing process description, wastewater characteristics and waste treatment flow sheet for – Textiles, Tanneries, Pulp and paper, Metal finishing (plating anodizing), Petroleum Refining, Sugar and Distilleries, Dairy, Iron and steel, Fertilizers.

Books and References

1. Eckenfelder, W.W., (1999) “Industrial Water Pollution Control”, Mc-Graw Hill.
2. Arceivala, S.J., (1998) “Wastewater Treatment for Poll. Control”, Tata McGraw Hill.
3. World Bank Group (1998)”Pollution Prevention and Abatement Handbook – Towards
4. Cleaner Production “, World Bank and UNEP, Washington D.C.

MTE – 202 ENVIRONMENTAL IMPACT ASSESSMENT, POLICIES AND AUDIT

Unit I: Introduction

Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS) – Environmental Risk Assessment (ERA) – Legal and Regulatory aspects in India – Types and limitations of EIA – Terms of Reference in EIA- Issues in EIA – national – cross sectoral – social and cultural.

Unit II: Components and Methods of EIA

Components – screening – setting – analysis – prediction of impacts – mitigation. Matrices – Networks – Checklists. Importance assessment techniques – cost benefit analysis – analysis of alternatives – methods for Prediction and assessment of impacts – air – water – soil – noise – biological – cultural – social – economic environments. Standards and guidelines for evaluation.Public Participation in environmental decision making.

Unit III: Policies and Quality Control

Environmental Policies- National and International; International treaties, Carbon management-Kyoto Protocol and Clean Development Mechanism (CDM), Carbon Neutrality.Environmental Legislations-Acts, Rules, Regulations and Notifications.Environmental standards,Criteria for standard setting.

Unit IV: Audit, Documentation and Monitoring

Environmental audit, objectives, types, features, planning of audits; Organisation of AuditionProgramme, pre-visit data collection. Audit Protocol; Onsite Audit; Data Sampling-Inspections-Evaluation and presentation; Exit interview; Audit Report- Action Plant-Management of Audits;Waste Management Contractor Audits. Life Cycle Approach.

Unit V: Case Studies

Case studies of EIA of developmental projects (Express highway, Petroleum Industry, Dam, etc.)

Books and References

1. Canter, L.W., " Environmental Impact Assessment ", McGraw Hill, New York, 1996.
2. Petts, J., " Handbook of Environmental Impact Assessment Vol. I and II ", Blackwell Science,London, 1999.
3. The World Bank Group., " Environmental Assessment Sourcebook Vol. I, II and III ", TheWorld Bank, Washington, 1991.
4. Strategic Environmental Assessment – RikiTherirvel, E.Wilson, S.Thompson, .Heaney, D. Pritchard. Earthscan,London, 1992.
5. Environmental Impact Assessment-Cutting edge for the 21st century – Alan Gilpin, CUP, London, 1994.
6. Environmental Impact Assessment-Theory & Practice – Peter Wathern, UnwinHynman, Syndeny, 1988.
7. A Practical Guide to Environmental Impact Assessment – Paul, A Erickson, Academic Press, 1994.

MTE – 203 Industrial safety, Environmental Health and Disaster Management

Unit I: Disaster Management

Disasters: Natural- Earthquake, flood, volcanic eruption, cyclones. Manmade- Failure of dams, leakage, explosion, oil-spills and fire of hazardous chemicals. Leakage in atomic reactor plants. Mining disaster. Monitoring of critical parameters. Risk-analysis, HAZOP, Consequence Analysis. Fault Tree analysis and Event Tree analysis. Emergency Management: Indian and foreign legislations. Case studies.

Unit II: Industrial Safety

Organizing for Safety: Definition, need, nature and principles. Directing for Safety: Direction, definition, process, principles and techniques, Leadership: Monitoring for Safety, Health & Environment: Occupational Safety, Health and Environment Management System, Bureau of Indian Standards on Safety and Health: 14489-1998 and 15001- 2000, ILO and EPA Standards.

Unit III: Environmental & Occupational Health

Definition: As per WHO. Common occupational diseases, Occupations involving risk of contracting diseases, Mode of causation of the diseases and its effects, Diagnostic methods used for detecting occupational diseases. Biological monitoring. Evaluation of injuries, Hierarchy of control measures for occupational health risks, Occupational health management services at the work place. Lung function test on Medspirator, Ear testing on Audiometer. Physical health hazards, Chemical health hazards, Industrial dermatosis, Control methods and reduction strategies for air pollutants, noise and radiations. Prevention and control of occupational diseases. Environmental monitoring and occupational exposure limits.

UNIT IV: Personal Protective Equipments

Role of personal protective equipment, Selection criteria for personal protective equipment, Respiratory and non-respiratory type personal protective equipments

UNIT V: Case Study on Safety Aspects in Industries

- Safety in chemical industry
- Safety in textile industry
- Safety in pharmaceutical industry
- Safety in food industry
- Safety in mine industry

Books & References:

1. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad (1993).
2. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi (1999).
3. Environmental Toxicology and Chemistry: Donald G. Crosby, Oxford University Press, USA (1998).
4. Handbook of Environmental Risk Assessment and Management: Peter Calow, Blackwell Science Ltd., USA (1998).
5. Principals of Environmental Toxicology: Ian C. Shaw and John Chadwick, Taylor and Francis, USA (1998).
6. The Factories Act-1948, Government Printing Press, Civil lines, Delhi (1994).
7. Risk Assessment and Environmental Management: D. Kofi Asvite-Dualy, John Willey & Sons, West Sussex, England (1998).
8. Introduction to Environmental Engineering & Science: Gilbert M. M., Pearson Education, Singapore (2004).

MTE – 204 SOLID AND HAZARDOUS WASTE MANAGEMENT

Unit I: Nature of Solid Wastes

Definition of solid waste, Industrial mining, Agricultural and domestic (urban) waste, Waste generation in Technological societies, Major legislations, Monitoring responsibilities, Sources & types of solid wastes, Sampling & characterization, Composition of MSW, Storage, Handling & future changes in waste composition

Unit II: Collection & Transport of Solid Waste

Collection of solid wastes, Types of solid wastes collection systems, Analysis of collection systems, Alternative Techniques for collection systems, Collection & Transformation of solid wastes, Unit operations used in separating and processing material recovery facility, Need for transfer operations, Transport means and methods, Transfer stations types & design.

Unit III: Solid Waste Disposal

Sanitary landfill- planning, Site selection, Design and operation, Aerobic landfill stabilization, Biological oxidation, Composting, Vermicomposting, Pyrolysis, Incineration & Energy Recovery, Bioremedial Waste categorization, Land reclamation – pre & post project land use planning, Physical, Chemical & Biological reclamations.

Unit IV: Hazardous Waste Management

Definition & identification of Hazardous Wastes, Sources & Characteristics of hazardous wastes, Hazardous waste in municipal waste, Hazardous waste regulations & legislations, Minimization of Hazardous wastes, Handling & storage of Hazardous wastes, Landmark episodes.

Unit V: Hazardous Waste Treatment

Hazardous Waste Treatment technologies, Physical, chemical & thermal methods of stabilizations, Solidification, Chemical Fixation & encapsulation, Incineration of Hazardous waste landfills, Reclamation of Hazardous waste landfill sites.

Books & References

2. Solid wastes : Engineering Principles & Management Issues, Tchobanglous G, Thesien GH, Eliassen R, Mc Graw Hill Int. ED, Singapore, 1977
3. Solid waste management, Montell CL, John Willey, NY, 1975
4. Environmental engineering, Peavy HS, Rowe D R
5. Technobanglus G, Thesien GH, Mc Graw Hill Int. ED, Singapore, 1985
6. Hazardous waste management, Lagrega MD, Buckingham PL, Evans JV, McGraw Hill Int. Ed. NY, 2001
7. Biremediation Principles, Eweie JB, Ergas SJ, Chang DYP & Schroder ED, McGraw Hill Int. Ed. Singapore, 1988

MTE – 205 ENVIRONMENTAL GEO-TECHNOLOGY

Unit I: Introduction

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.

Unit II: 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.

Unit III: 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

Unit IV: Hazardous Waste Disposal

Hazardous waste control and storage system-Stabilization /Solidification of wastes-Processes and Functions- Monitoring and performance of contaminant facilities-Environmentally safe disposal of solid and liquid waste

Unit V: Remedial Measures

Ground modification techniques in waste fill, Remedial measures for contaminated grounds-Remediation technology-Bio-remediation

Books and References

1. Wentz,C.A., " Hazardous Waste Management ", McGraw Hill, Singapore, 1989.
2. Daniel,B.E., " Geotechnical Practice for Waste disposal ", Chapman and Hall, London, 1993.
3. " Proceedings of the International symposium of Environmental Geotechnology (Vol.I and Vol.II) ",
4. Environmental Publishing Co., 1986 and 1989.
5. Ott, W.R., " Environmental Indices ", Theory and Practice, Ann, Arbor, 1978.
6. Fried, J.J., " Ground Water Pollution ", Elsevier, 1975.
7. ASTM Special Technical Publication 874, " Hydraulic Barrier in Soil and Rock ", 1985.
8. Westlake, K., (1995), " Landfill Waste Pollution and Control ", Albion Publishing Ltd., England, 1995.
9. Lagrega, M.D., Buckingham, P.L. and Evans, J.B., " Hazardous Waste Management ",McGraw Hill, Inc., Singapore, 1994

MTE – 206 NATURAL RESOURCE MANAGEMENT

Unit I: Mineral Resources Evaluation and its Role In National Economy

Methods of evaluation of minerals, rocks, water, soil and fossil fuels. Collection of data, sampling technique and instrumentation, preservation of samples, preparation of thematic and resource maps for rocks, ores and minerals. Quality and feasibility assessment of rocks and minerals for building, decorative, ornamental, and jewellery purposes. Evaluation of medicinal values of minerals. Principles of mineral economics, significance of mineral resources in national economy, Production, demand, supply and substitution of natural resources in global context. Commercial grade Classification of ore reserves. Ore reserve estimation. Economic evaluation of ore deposit. Preparation of technical report.

Unit II : Marine Resources Management

Introduction to marine resources, Factors controlling abiotic resources and their distribution - polymetallic manganese nodules, phosphorites, hydrocarbons, beach placers evaporates, rare metals, corals, pearls and shells. Prospecting and mining of the ocean floor, Management of marine resources, demand, supply and production of marine resources. Policies and acts relating to ocean and land.

Unit III : Land Resource Management

Land as a natural resource, biotic and abiotic and their importance in sustainable developments. Classification of lands - techniques of terrain evaluation. Land use and land cover classification, Study of soils, their uses, components and profiles. Physical chemical and engineering properties of soils and classification of soils. Soil erosion and preventive measures.

Unit IV: Water Resource Management

Importance of water management, Concept of planning and design of percolation tanks, dry land farming and water management, watershed management and watershed programmes. Methods of rainwater harvesting and techniques, necessity of planned water supplies. Planning and execution of modern water supply schemes, India's water budget, demand and supply, state and central policies, acts and taxation system, water dispute and case studies.

Unit V: Forest and Agriculture Studies

Crop type classification, area estimates, and spectral response of different crops. Crops diseases and Assessment, Crop and Water management and monitoring. Advances in Crop monitoring by RS, Soil Survey and mapping, soil conservation and watershed management Landuse/Landcover mapping and planning, Geomorphology in soil survey and mapping soil erosion, case studies.

BOOKS & REFERENCES

1. Introduction to oceanography. H.V. Thurman
2. Hand book of subsurface geology - C.A.Moore
3. Principles of Geomorphology - Thornburry
4. Petroleum stratigraphy - R.L.Breuner
5. World oil energy economics - H.A,.Kerklelin
6. Geology of petroleum - A.I.Levorsen.
7. Landform - Shall (1991).
8. Mining methods - R.N.P. Arogyaswamy
9. Introduction to India's economic minerals - Sharma, N.L. & Ram . K.S.
10. Non Fuel mineral deposits of India 1999: Mukerjee., Allied Publ.
11. Ground water hydrology - DK Todd
12. Hand Book of applied Hydrology - Ventechow
13. Hydrology - Davis and Dewiest

MTE - 207 PRACTICAL COURSE ON ABOVE COURSES

1. Demonstration of air pollution monitoring instruments; Calibration of HVS by orifice method;
2. Determination of SPM; PM_{10}; Respirable dust monitoring
3. SO_2; NOx and CO in ambient air;
4. Determination of chlorine demand, break-point chlorination and
5. free residual chlorine;
6. Na and K in sewage sample, wastewater and natural water;
7. Determination of Nitrate-nitrogen (NO3-N) concentration in domestic sewage, wastewater, surface water sample and underground water sample.
8. Determine chloride, acidity and alkalinity of raw sewage, wastewater, natural surface water and compare the results
9. MLSS and MLVSS. Sludge Volume Index (SVI) and development of sludge settling characteristics curve and design of PST based on settling curve.
10. Determine TS, TSS, TDS and settle able solids in domestic sewage.
11. Calculation of inorganic and organic portions. Determination of BOD5: TKN ratio and comment on the treatment process for biological removal of nitrogen. Derive the COD:BOD5 ratio and use the same data for BOD5:TKN ratio estimation.
12. Jar-Test of filtered domestic wastewater and determination of optimum dose on the basis of COD and turbidity removal.
13. Computer programming for determination of wind profile.
14. Demonstration of UV-VIS spectrophotometer, Flame photometer, AAS, GC, TOC etc.
15. Bacteriology of drinking water and MPN techniques for total coliform; faecal coliform
16. Bacteriology of domestic sewage MPN techniques for total coliform; faecal coliform
17. Membrane filtration techniques for faecal coliform and total coliform
18. Microbiology of Air: by exposure plate method;
19. Use of nutrient agar medium, enumeration and identification of fungal mycelium and spores;
20. Microbiology of soil- Heterotropic bacterial counts by colony counter

SEMESTER III

MTE 301: SEMINARS AND INDUSTRIAL VISITS

- Seminars on recent topics in environment management.
- Industrial visits to study the process and sources of waste generation and waste management.

MTE 302: MID TERM PROJECT PRESENTATION

The project pertaining to pollution control / safety audit / EIA / environmental audit / resource management can be under taken by the student.

SEMESTER IV

MTE – 401 DISSERTATIONS & PROJECT WORK

On the completion of project work each student has to submit for examination, a dissertation embodying the results of the research work carried out by him / her. The viva – voce examination will be conducted by the Board of Examiners to be constituted by N.M.U.