MAHATMA GANDHI UNIVERSITY

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

CIVIL ENGINEERING

WITH SPECIALIZATION IN

ENVIRONMENTAL ENGINEERING

(2013 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN CIVIL ENGINEERING WITH SPECIALIZATION IN ENVIRONMENTAL ENGINEERING

SEMESTER - II

Sl. No.	Course No.	Subject	Hrs / Week			Evaluation Scheme (Marks)					Credits (C)
			L	T	P	Sessional			ESE	Total	
						TA	CT	Sub Total			
1	MCEEE 201	Principles And Design Of Biological Treatment Systems	3	1	0	25	25	50	100	150	4
2	MCEEE 202	Air Quality Management And Meteorology	3	1	0	25	25	50	100	150	4
3	MCEEE 203	Industrial Water Pollution Control	3	1	0	25	25	50	100	150	4
4	MCEEE 204	Air and Water Quality Modeling	3	1	0	25	25	50	100	150	4
5	MCEEE 205	Elective - III	3	0	0	25	25	50	100	150	3
6	MCEEE 206	Elective - IV	3	0	0	25	25	50	100	150	3
7	MCEEE 207	Advanced Environmental Engineering Lab	0	0	3	25	25	50	100	150	2
8	MCEEE 208	Seminar - II	0	0	2	50	0	50	0	50	1
Total			**18**	**4**	**5**	**225**	**175**	**400**	**700**	**1100**	**25**

Elective – III (MCEEE 205)		Elective – IV (MCEEE 206)	
MCEEE 205 - 1	Instrumental Methods In Environmental Engineering	MCEEE 206 - 1	GIS And Remote Sensing For Environmental Applications
MCEEE 205 - 2	Water Pollution Control And Stream Sanitation	MCEEE 206 - 2	Ground water contamination and Transport Modeling
MCEEE 205 - 3	Membrane Technology For Water And Wastewater Treatment	MCEEE 206 - 3	Environment, Health and Safety in Industries
MCEEE 205 - 4	Marine Pollution Monitoring	MCEEE 206 - 4	Fundamentals Of Sustainable Development

L – Lecture, **T** – Tutorial, **P** – Practical

TA – Teachers' Assessment (Quizzes, attendance, group discussion, tutorials, seminar, field visit etc)

CT – Class Test (Minimum of two tests to be conducted by the Institute)

ESE – University End Semester Exam will have to be conducted by the institute through concerned affiliating University.

MCEEE 201 PRINCIPLES AND DESIGN OF BIOLOGICAL TREATMENT SYSTEMS

L	T	P	C
3	1	0	4

Objective: To familiarize the students with collection and characterization of wastewater samples, their treatment and disposal and advanced wastewater treatment process and their applications

Module 1

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

Module 2

Design of aerobic treatment systems: Design of sewage treatment plant units –Activated Sludge process Various types – Methods of aeration –Process analysis – Process design considerations – Operational difficulties – Modifications.

Aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems, constructed wet land – disposal options – reclamation and reuse – Flow charts, layout, hydraulic profile, recent trends.

Module 3

Trickling Filters-Filter classifications – Process design considerations – Design of physical facilities – Recirculation – NRC Equation – Operational difficulties. Bio Tower-RBC-Moving Bed Reactors-fluidized bed reactors

Sequencing Batch Reactor – Process description and operation, Membrane Biological Reactors – Process description and operation.

Module 4

Anaerobic treatment of wastewater: Process fundamentals-Standard, high rate and hybrid reactors.

Anaerobic filters-Expanded /fluidized bed reactors-Up flow anaerobic sludge blanket reactors, Expanded granular bed reactors- Two stage/phase anaerobic reactors.

Anaerobic Suspended growth reactors: septic tank, Imhoff tank Design, operation and disposal.

Nitrogen removal – Nitrification and Denitrification. Sludge Digestion and Sludge disposal

REFERENCES:

1. Arceivala, S.J., Wastewater Treatment for Pollution Control, TMH, New Delhi, Second Edition, 2000.
2. Manual on “Sewerage and Sewage Treatment” CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
3. Metcalf & Eddy, INC, ‘Wastewater Engineering – Treatment and Reuse, Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003.
4. Qasim, S.R. Wastewater Treatment Plant, Planning, Design & Operation, Technomic Publications, New York, 1994.
5. Benefield and Randall- Biological treatment Process – Design for waste water treatment, Prentice Hall of India, New Delhi.
6. Hammer- Water and Waste Water Technology, John Wiley and Sons
7. Quano- Principles of Waste Water Treatment, Vol. I, Oxford and IBH

MCEEE 202 AIR QUALITY MANAGEMENT AND METEOROLOGY

L	T	P	C
3	1	0	4

Objective: *To familiarize the students with collection and characterization of ambient and stack air samples, their treatment and control. Importance of mathematical models and meteorology in air pollutant dispersion and its concentration.*

MODULE 1

Air pollution – sources and effects – Definition and concentrations, classification and properties of air pollutants, emission sources, major emissions from global sources, importance of Anthropogenic sources, behaviour and fate of air pollutants. Photochemical smog, Effects of air pollution on health, vegetation and materials damages.

Meteorological aspects of air pollutant dispersion – Temperature lapse rates and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, solutions to the atmospheric dispersion equation, The Gaussian plume model.

MODULE 2

Air pollution sampling and measurement – Types of pollutant sampling and measurement, ambient air sampling, collection of gaseous air pollutants, collection of particulate pollutants, stack sampling, analysis of air pollutants – sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozone, hydrocarbons, particulate matter.

MODULE 3

Air pollution control methods and equipment – Control methods, source correction methods, cleaning of gaseous effluents, particulate emission control – gravitational settling chambers, cyclone separators, fabric filters, electrostatic precipitators, wet scrubbers, selection of a particulate collector, control of gaseous emissions, absorption by liquids, adsorption by solids, combustion, biological methods

MODULE 4

Control of specific gaseous pollutants – Control of sulphur dioxide emission, desulphurisation of flue gases, Dry methods, wet scrubbing methods, control of nitrogen oxides, Modification of operating conditions, modification of design conditions, effluent gas treatment methods, Carbon monoxide control, control of hydrocarbons, mobile sources.

Air pollution laws and standards.

References:-

1.C.S.Rao. Environmental Pollution Control Engineering, Wiley Eastern Ltd, Delhi
2.Stern A. Air pollution Control vols 1, 2, 3. Academic press, New York
3.Magill. P. L. Air pollution hand book McGraw -Hill.
4.De Nevers Air Pollution Control Engineering McGraw-Hill.
5.Ch hatwal G.R. Encyclopedia of Environmental Pollution and Control. Vol 1,2,3 Anmol Publications

MCEEE 203 INDUSTRIAL WATER POLLUTION CONTROL

L	T	P	C
3	1	0	4

Objective: To provide information regarding different elements of water pollution and methods of treatment. Also to expose students to the various industrial processes and the origin, characteristics and treatment of waste water generated.

MODULE 1

Damages caused by industrial pollution- Effects of industrial waste on stream- Effects of industrial waste on sewage treatment plants- Study of some typical problem caused by industrial pollution in India – Need for environment impact assessment for major industries.

MODULE 2

Volume reduction of industrial waste- strength reduction of industrial waste- neutralization- equalization and proportioning

Joint treatment of raw industrial waste with domestic sewage- Joint treatment of partially treated industrial waste with domestic sewage – Discharge of treated waste to municipal sewers- Stream protection measures.

MODULE 3

Industrial manufacturing process, Characteristics of waste, waste management and treatment methods in the following industries -Textile mills, Dairy plant, Canneries, Tanneries, Distilleries, Fishing industry, Sugar mills , Pulp and paper mills and Rubber industry.

MODULE 4

Industrial manufacturing process, Characteristics of waste, waste management and treatment methods in the following industries - Metal plating industry, Oil refineries, Petrochemicals, Fertilizer plant, steam and nuclear power plants.

References

1. N.L. Nemerrow –Theories and practices of Industrial Waste Engineering.
2. C.G. Gurnham –Principles of Industrial Waste Engineering.
3. M.N. Rao and Dutta – Industrial Waste.
4. Berne F. – Industrial Waste Treatment

MCEEE 204 AIR AND WATER QUALITY MODELING

L	T	P	C
3	1	0	4

Objective: To educate the students on the basic principles, development and application of air and water quality models with computer applications

MODULE 1

Modeling/Concept: Water and air quality management – Role of mathematical models; systems approach – systems and models – kinds of mathematical models – model development and validation effluent and stream standards; ambient air quality standards.

MODULE 2

Water Quality Modeling: Historical development of water quality models; rivers and streams water quality modeling – river hydrology and flow – low flow analysis – dispersion and mixing – flow, depth and velocity – estuaries – estuarine transport, net estuarian flow, estuary dispersion coefficient; Lakes and impoundments – Water quality response to inputs; water quality modeling process – model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens; Streeter – Phelps models.

MODULE 3

Air Quality Modeling: Transport and dispersion of air pollutants – wind velocity, wind speed and turbulence; estimating concentrations from point sources – the Gaussian Equation – determination of dispersion parameters, atmospheric stability; dispersion instrumentation – Atmospheric traces; concentration variation with averaging time; Air pollution modeling and prediction – Plume rise modeling techniques, modeling for non-reactive pollutants, single source – short term impact, multiple sources and area sources, model performance and utilisation, computer models.

MODULE 4

Groundwater Quality Modeling: Mass transport of solutes, degradation of organic compounds, application of concepts to predict groundwater contaminant movement, seawater intrusion – basic concepts and modeling

Computer Models: Exposure to computer models for surface water quality, groundwater quality and air quality.

References:

1. Steven C.Chapra, Surface Water Quality Modeling, The McGraw-Hill Companies,Inc., New York, 1997.
2. R.W.Boubel, D.L. Fox, D.B. Turner & A.C. Stern, Fundamentals of Air Pollution Academic Press, New York, 1994.
3. Ralph A. Wurbs, Water Management Models – A Guide to Software, Prentice Hall. PTR, New Jersey, 1995.

MCEEE 205 – 1 INSTRUMENTAL METHODS IN ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Objective: To provide information regarding principles and details of quantitative analysis of different parameters present in water and air.

MODULE 1

Instrumental methods in environmental engineering, analytical methods, chemical, instrumental and biological methods. Analytical instruments and process instruments, sensors, body of the instrument, read out, accuracy, precision, sensibility, range, resolution. Transducers, measurement of nonelectrical quantities like pressure, temperature, displacement, velocity, acceleration etc. strain gauge and its applications, use of microprocessors in instrumentation.

MODULE 2

Potentiometer: pH meter, ion selective electrodes, redox potential. Polarographic analysis, photometry, DO meter, conductivity, colourimetry and its applications.

Optical methods of analysis: absorption and emission methods, visible spectrum photometer, U.V. Spectrometer, infrared spectrometer, flame photometer, atomic absorption spectrophotometer. X-ray diffraction method, mass spectrometer, methods using microscopy, refractrometric method.

MODULE 3

Dispersion and scattering: turbidimetry and nephelometry, fluorimetry. Thermal conductivity method , radioactivity methods, sound absorption method.

MODULE 4

Chromatography: general principles and specific techniques-thin layer, column, liquid, high performance, ion etc. Air and water pollution control instrumentation, computer aided analysis, process instrumentation and control in lab and pilot experiments. Process Control Instrumentation: basic design concepts for air ,water and waste water treatment process instrumentation

References:

1. Sawyer and McCarty-Chemistry for environmental engineering, McGraw Hill
2. Kemmer-The NALCO Water Handbook, McGraw Hill
3. Galen Wood Ewing - Instrumental methods of chemical analysis, McGraw Hill
4. Howard A. Strobel, William R. Heineman: Chemical instrumentation: a systematic approach, Wiley

MCEEE 205 – 2 WATER POLLUTION CONTROL AND STREAM SANITATION

L	T	P	C
3	0	0	3

Objective: To make the students aware about the sources of surface water pollution, their control and stream quality standards

MODULE 1

Introduction-importance of water sources-socio-economic importance-sources of pollution-types of waste-waste products of man's activities-sources of stream pollution-types of waste products-location and management of waste loads-projecting waste loadings. Water quality and stream quality standards

MODULE 2

Eutrophication-organic pollution-oil pollution-radioactive pollution-marine pollution-thermal pollution-pesticide pollution-heavy metal pollution

Organic self purification-quantitative definition- reoxygenation-oxygen balance and stream dissolved oxygen profile-oxygen sag curve-Streeter Phelp's equation-Critical deficit-problems

Microbial purification-pathogenic microorganisms of sewage origin-indices of contamination-enumeration-percapita contribution-seasonal variations-death rate survival in the stream environment

MODULE 3

Classification of streams-natural self purification process-disposal of wastewater-

Rational stream sanitation practices-dual objectives of stream sanitation practices-the science and art of applied stream sanitation-stream survey-types of stream survey-execution of stream surveys

Purification in estuaries- self purification in estuaries-tides and currents- distribution of waste loads by tidal translation-sea water intrusion-waste assimilation capacity of estuaries-bacterial contamination-stable wastes

MODULE 4

Impacts of river developments waste assimilation capacity, socio-economic sector - detrimental and beneficial effects-hydroelectric power-navigation works-flood control works-irrigation and other diversions

Case Studies for river cleaning program (Ganga & Pampa action Plan). Legal measures in river protection.

References:-

1.Phelps E. Stream Sanitation
2.Viez Applied stream sanitation
3. P. K. Goel Water pollution, causes, effects and control
4.Todd G. K. Applied Groundwater hydrology

MCEEE 205 – 3 MEMBRANE TECHNOLOGY FOR WATER AND WASTEWATER TREATMENT

L	T	P	C
3	0	0	3

Objectives: the students are expected to know the advancements in the field of membrane technology for the treatment of water and wastewater.

MODULE 1

Solid Liquid separation systems - Filtration systems - Theory of Membrane separation – mass Transport Characteristics Cross Flow filtration - Membrane Filtration - Types and choice of membranes, porous, non porous, symmetric and asymmetric – Plate and Frame, spiral wound and hollow fibre membranes – Liquid Membranes

MODULE 2

Membrane Processes And Systems: Microfiltration – Ultra filtration- Nano Filtration – Reverse Osmosis – Electro dialysis - Pervaporation – Membrane manufactures – Membrane Module/Element designs – Membrane System components – Design of Membrane systems - pump types and Pump selection – Plant operations – Economics of Membrane systems.

MODULE 3

Membrane Bioreactors: Introduction and Historical Perspective of MBRs, Biotreatment Fundamentals, Biomass Separation MBR Principles, Fouling and Fouling Control, MBR Design Principles, Design Assignment, Alternative MBR Configurations, Commercial Technologies, Case Studies.

MODULE 4

Pretreatment Systems: Membrane Fouling – Pretreatment methods and strategies – monitoring of Pretreatment – Langlier Index, Silt Density Index, Chemical cleaning , Biofoulant control.

Case Studies : Case studies on the design of membrane based water and wastewater treatment systems – zero Liquid effluent discharge Plants.

References:

1. Mulder, M., Basic Principle of Membrane Technology, Kluwer Academic Publishers, 1996
2. Water Environment Federation (WEF), Membrane Systems for Wastewater Treatment, McGraw-Hill, USA, 2005
3. Simon Judd, MBR Book – Principles and application of MBR in water and wastewater treatment, Elservier, 2006
4. Jorgen Wagner, Membrane Filtration handbook, Practical Tips and Hints, Second Edition, Revision2, Osmonics Inc., 2001
5. Noble, R.D. and Stern, S.A., Membrane Separations Technology: Principles and Applications, Elservier, 1995

MCEEE 205 – 4 MARINE POLLUTION MONITORING

L	T	P	C
3	0	0	3

Objective: To educate the students on aspects of marine pollution and methods of water quality assessment and marine pollution control

MODULE 1

Oceanography:

General features of ocean – Conservation laws – Wave characteristics and theories – Sediment transport – Tides – Ocean Currents – Thermocline circulation – General circulation of ocean waters, Tsunamis, Storm surge – Principles of Marine geology

MODULE 2

Coastal Environment

Living resources – coral reefs, mangroves, seagrass, seaweeds, fishery potential – nonliving resources – manganese nodules, heavy minerals – Beaches, Estuaries, Lagoons – Shoreline Changes

MODULE 3

Marine Surveying: Sea surveying planning and preparation – Oceanographic instrumentation – Hydrographic Surveying – Underwater surveying – Measurement of physical properties of ocean water - sea bed sampling

MODULE 4

Marine Pollution, Monitoring and control: Physicochemical properties of sea water – Sources of marine pollution and impacts on coastal ecosystems, Oil pollution – oil spill detection, dispersion, impacts on adjacent area – Oil spill modeling, mitigation measures – Oil exploration and their effects – Marine outfalls – Impacts of Ports and Harbor on marine water quality – dredging – Human intervention in estuarine ecosystem – sea water classification – Physical modeling in Coastal Engineering – Ocean monitoring satellites

– Applications of Remote sensing and GIS in marine studies. National and International treaties, protocols in marine pollution – Exclusive Economic Zone – Sustainable development. Costal regulation zone

References :

1. Kennish, M.J., Pollution impacts on Marine Biotic Communities, CRC press, New York, 1998.
2. Newman, M.C., Roberts Jr. M.H., Male R.C. (Editors), Coastal and Estuarine Risk Assessment, Lewis Publishers, Washington, D.C., 2002.
3. U.S. Army Corps of Engineers, Shore Protection Manual, Washington D.C., 2002.

MCEEE 206 – 1 GIS AND REMOTE SENSING FOR ENVIRONMENTAL APPLICATIONS

L	T	P	C
3	0	0	3

Objective: To make the students understand the basics of emerging fields -remote sensing principles and Geographic Information System- so that they can utilize it for environmental system modeling

MODULE 1

Introduction to remote sensing – Electromagnetic spectrum – Physics of remote sensing – Effects of atmosphere – Atmospheric windows – Interaction of earth surface features with EMR – Spectral characteristics of vegetation, water, soil, etc. –

Various types of platforms– Airborne and space based platforms - Different types of aircraft – Manned and unmanned spacecraft used for data acquistion – Characteristics of different types of platforms – Characteristics of Remote Sensors –Multi spectral sensors – Multi Spectral Scanners – Microwave remote sensing- Factors affecting Microwave measurement-Radar wave bands- SLAR and SAR.

MODULE 2

Sensors- Satellite system parameters- sensor parameters-spatial, spectral and radiometric resolution – False colour composite (FCC) – Multi spectral photographs – Thermal and microwave imaging system-Earth Resources satellite and Meteorological satellites

Different types of data products and their characteristics – Image Interpretation - Basic principles of visual interpretation – Elements of image interpretation - Equipment for visual interpretation – Activities of image interpretation – Ground truth - Basic principles of digital image processing – filtering

MODULE 3

Geographic Information system – History and development of GIS – GIS definitions and Terminology -Architecture– System concepts – Coordinate systems – Standard GIS packages.

Type of data – Spatial and non- spatial data – Data structure – Points – Lines – Polygon – Vector and raster – Files and data formats – Spatial data modeling –Raster GIS model and Vector GIS models.-GIS data file management and Database models

MODULE 4

Data input and data editing-Input methods –GPS as data capture-data editing.

Spatial analysis – Data retrieval – Query – Simple analysis – Record – Buffering and Overlay – Vector data analysis – Raster data analysis – Modeling in GIS – Digital elevation model – DTM – Modeling Networks

Integration of RS and GIS – Need and Facilities for integration. Application of these to water resources and environmental engg-Cadestral records and LIS

References:

1.Lillesand T.M. and Kiefer R.W., Remote sensing and Image Interpretation, Second Edition, John Wiley and Sons, 1987.

2.AnjiReddy, M. Remote Sensing and Geographical Information System, BSP Publications., 2001.
3.Chang, K (2005). Introduction to Geographic Information Systems, *Tata Mc Graw Hills Edition, NewDelhi*.
4.Manual of Remote Sensing, American Society of Photogrammetry and Remote Sensing, 1993.
5.Paul Curran P.J., Principles of Remote Sensing , ELBS, 1983.
6.Sabins F.F. Jr., Remote Sensing Principles and Interpretation, W.II. Freeman and Company, 1978.
7.Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992.
8.Burrough P.A., Principles of GIS for Land Resources Assessment, Oxford Publication, 1980.
9.Jeffrey Star and John Estes, Geographical Information System – An Introduction, Prentice – Hall Inc., 1990.
10.Marble D.F., Galkhs H.W. and Pequest, Basic Readings in Geographic Information System, Sped System Ltd., New York, 1984.
11.Clarke, K.C. Parks B.O., and Crane M.P. (2006) Geographic Information systems and environmental modeling- PHI of India , New Delhi.

MCEEE 206-2 GROUND WATER CONTAMINATION AND TRANSPORT MODELING

L	T	P	C
3	0	0	3

Objective: To educate the students on the hydraulics related ground water contamination and modeling ground water quality.

MODULE 1

Ground water and the hydrologic cycles-Ground water as a resource-Ground water contamination-Ground water as a geotechnical problem-Ground water and geologic processes. Physical properties and principles-Darcy's law-Hydraulic head and fluid potential-piezometers and nests. Hydraulic conductivity and permeability-homogenicity and anisotropy-porosity and voids ratio-Unsaturated flow and the water table-steady state flow and transient flow-compressibility and effective stress-transmissivity and storativity-Equations of ground water flow -Limitations of Darcian Approach-hydro dynamic dispersion.

MODULE 2

Resource evaluation: development of ground water resources-Exploration of Aquifers-the response of ideal aquifers to pumping-Measurement of parameters-Laboratory tests-Numerical simulation for aquifer yield prediction-Artificial recharge and induced infiltration-land subsidence - sea water intrusion

MODULE 3

Chemical properties and principles: constituents -chemical equilibrium-association and dissociation of dissolved species-effects of concentration gradients-mineral dissolution and solubility-Oxidation and reduction process-Ion exchange and adsorption-environmental isotopes-field measurement of index parameters. Chemical evolution: ground water in carbonate terrain-ground water in crystalline rocks-ground water in complex sedimentary systems -geotechnical interpretation of 14C dates-process rates and molecular diffusion.

MODULE 4

Solute transport: water quality standards-transport process-non reactive constituents in homogeneous media-transport in fracture media-hydrochemical behaviour of contaminants-trace metals-nitrogen-trace non metals-organic substances-measurement of parameters – velocity-dispersivity-chemical partitioning- sources of contamination-land disposal of solid waste-sewage disposal on land.

USGS-Moc model: modeling principles-MOC modeling.

References:

1.Todd David Keith, Ground water Hydrology, Fourth edition, John Wiley and Sons, New York, 2004..

2.Randall J. Charbeneau, “Ground water Hydraulics and Pollutant transport “Prentice Hall, Upper Saddle River, 1999.

3. Allen Freeze, R. and John A. Cherry, “Ground Water”, Prentice Hall, Inc., 2001.

MCEEE 206 – 3 ENVIRONMENT, HEALTH AND SAFETY IN INDUSTRIES

L	T	P	C
3	0	0	3

Objective: To make the students aware about environmental issues like adverse effect of pollutants on health and control methods for mitigating the effects

MODULE 1.

Introduction: Need for developing Environment, Health and Safety systems in work places. Status and relationship of Acts, Regulations and Codes of Practice. Role of trade union safety representatives. International initiatives. Ergonomics and work place.

MODULE 2

Occupational Health and Hygiene: Definition of the term occupational health and hygiene. Categories of health hazards. Exposure pathways and human responses to hazardous and toxic substances. Advantages and limitations of environmental monitoring and occupational exposure limits. Role of personal protective equipment and the selection criteria. Effects on humans, control methods and reduction strategies for noise, radiation and excessive stress.

MODULE 3

Workplace Safety and Safety Systems: Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies. Fire safety and first aid provision. Significance of human factors in the establishment and effectiveness of safe systems. Safe systems of work for manual handling operations. Control methods to eliminate or reduce the risks arising from the use of work equipment. Requirements for the safe use of display screen equipment. Procedures and precautionary measures necessary when handling hazardous substances. Contingency arrangements for events of serious and imminent danger.

MODULE 4

Techniques of Environmental Safety: Functions and techniques of risk assessment, inspections and audits. Investigation of accidents-Principles of quality management systems in health and safety management. Relationship between quality manuals, safety policies and written risk assessments. Records and other documentation required by an organisation for health and safety. Industry specific EHS issues.

Requirements and benefits of the provision of information, instruction, training and supervision. Factors to be considered in the development of effective training programmes. Principles and methods of effective training. Feedback and evaluation mechanism.

References:

1. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L.Graffia, William Andrew Inc. NY, 1995
2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.
3. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services 2005.

MCEEE 206 – 4 FUNDAMENTALS OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

Objectives: to make the students aware on the sustainability aspects in different fields of development.

MODULE 1

Principles of Sustainable Development: History and emergence of the concept of Sustainable Development – Definitions – Environmental issues and crisis – Resource degradation – green house gases – desertification – social insecurity – Industrialization – Globalization and Environment.

MODULE 2

Indians Judiciary System & Sustainable Development: Judicial System in India – Induction of sustainability concepts through legal systems – concepts – principles – doctrines – case laws.

Sustainable Development and International Contribution: Components of sustainability – Complexity of growth and equity – International Summits – Conventions – Agreements – Transboundary issues – Action plan for implementing sustainable development – Moral obligations and Operational guidelines

MODULE 3

Socio-economic Sustainable Development Systems: Socio-economic policies for sustainable development – Strategies for implementing eco-development programmes – Sustainable development through trade – Economic growth – Carrying Capacity – Public participation.

MODULE 4

Agenda for Future Global Sustainable Development: Role of developed countries in the sustainable development of developing countries – Demographic dynamics and sustainability – Integrated approach for resource protection and management.

Recent trends in Sustainable technological development.

References:

1. Kirkby, J., O' Keefe, P. and Timberlake, Sustainable Development, Earthscan Publication, London,1996.
2. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.
3. Bowers, J., Sustainability and Environmental Economics – an alternative text, Longman, London, 1997.

MCEEE 207 ADVANCED ENVIRONMENTAL ENGINEERING LAB

L	T	P	C
0	0	3	2

Microbial Analysis:

Culture media preparation – solid and liquid media. Preparation, distribution and sterilization.

Inoculation, streaking, colony observation. Colony counting technique for bacteria. Determination of total bacterial population by standard plate count technique.

Bacteriological examination of water. Multiple tube fermentation test – MPN technique for coliforms in water and sewage.

Estimation of metals:

Estimation of Heavy metals using atomic absorption spectrophotometer

Estimation of Na, K and Ca by flame photometer

Analysis of Air pollution: SPM and gaseous pollutant analysis

Characterization study of industrial wastewater sample

MCEEE 208 SEMINAR – II

L	T	P	C
0	0	2	1

Each student is required to present a technical paper on a subject approved by the department. The paper should be on a recent advancement/trend in the field of Environmental Engineering. He / she shall submit a report of the paper presented to the department.