

## *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

### SCHEME OF TEACHING AND EXAMINATION

#### M.E. (First Semester) Chemical Engineering (Environmental Engineering)

S.No.	Board of Studies	Code	Subject	Periods per week			Scheme of Exam			Grand Total	Credits L+(T+P)/2
				L	T	P	Theory / Practical				
							ESE	CT			
1	Chem. Engg	530111 (19)	Principals of Environmental Engg.	3	1	-	100	20	20	140	4
2	Chem. Engg	530112 (19)	Air Pollution Control	3	1	-	100	20	20	140	4
3	Chem. Engg	530113 (19)	Environment System Optimization	3	1	-	100	20	20	140	4
4	Chem. Engg	530114 (19)	Water Pollution Control	3	1	-	100	20	20	140	4
5	Refer Table - I	Elective-I		3	1	-	100	20	20	140	4
6	Chem. Engg.	530121 (19)	Air Pollution Control -Lab	-	-	3	75	-	75	150	2
7	Chem. Engg.	530122 (19)	Water Pollution Control - Lab	-	-	3	75	-	75	150	2
<b>Total</b>				<b>15</b>	<b>5</b>	<b>6</b>	<b>650</b>	<b>100</b>	<b>250</b>	<b>1000</b>	<b>24</b>

ESE: End Semester Examination

CT: Class Test

TA: Teacher's Assessment

L: Lecture

T: Tutorial P: Practical

**Table - I**

Elective – I			
S.No.	Board of Studies	Code	Subject
1	Chemical Engg.	530131 (19)	Energy & Environment
2	Chemical Engg.	530132 (19)	Natural Resource Management
3	Chemical Engg.	530133 (19)	Introduction to ANN & Ex. Sy.

**Note (1) –** 1/4<sup>th</sup> of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

**Note (2) –** Choice of elective course once made for an examination cannot be changed in future examinations.

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

**Semester: M.E. Ist**  
**Subject: Principles of Environmental Engg.**  
**Total Theory Periods:40**  
**Total Marks in End Semester Exam: 100**  
**Minimum number of class tests to be conducted :02**

**Branch: Chemical Engg. (Environmental Engg.)**  
**Code: 530111 (19)**  
**Total Tutorial Periods: 12**

Note: Internal choice may be given in any three units.

- Unit I** Overview of Environmental Systems; Water Quality Standards and Water Purification Processes; Nature of Sanitary And Industrial Wastewaters; Primary, Secondary And Advanced Treatment Methodologies And Water Reclamation.
- Unit II** Air Quality Standards; Classification of Atmospheric Pollutants And Systems For Control of Air Pollution From Industries.
- Unit III** Noise Pollution and Control: Sources of Noise Pollution, Characteristics of Sound, Measurement of Noise, Community Noise, Sources & Criteria; Types, Effects & Control of Noise Pollution, Protective Devices against Noise Pollution, Rating Systems.
- Unit IV** Principles of Solids And Hazardous Waste Treatment, Potentials For Resource And Energy Recovery.
- Unit V** Basic Concept of Ecology; Ecosystem, Development And Evaluation of Ecosystem, Case Studies on Some Ecological Problems Relevant to India.

#### **Text Books:**

1. H.S. Peavy, D.R.Rowe, G. Tchobanoglous: Environmental Engineering, McGraw-Hill, 1985.
2. R.Socolow, C Andrews, F. Berkhont and V. Thomas. Industrial Ecology and Global change, Cambridge University, 1994.

#### **Reference books:**

1. M.L.Davis and D.A. Cornwell: Introduction to Environmental Engineering.
2. Martin Crewford: Air Pollution Control

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

**Semester: M.E. Ist**

**Subject: Air Pollution Control**

**Total Theory Periods: 40**

**Total Marks in End Semester Exam: 100**

**Minimum number of class tests to be conducted :02**

**Branch: Chemical Engg.(Environmental Engg.)**

**Code: 530112 (19)**

**Total Tutorial Periods: 12**

- Unit I** Sources And Classification of Air Pollutants; Emission Standards And Qualities; Nature And Characteristics of Gaseous And Particulate From Different Sources Like Automobiles And Thermal Power Plants; Primary And Secondary Air Pollutants, Effect of Air Pollution; Mechanism of Deterioration of Air Quality Due to Various Air Pollutants And Aerosols; Petrochemical Air Pollution; Pollution Due to Cement And Steel Industries; Pollutants – Carbon Mono-oxide, Oxides of Nitrogen, Oxides of Sulfur, Hydrocarbon And Dust.
- Unit II** Control of Gaseous Emission: Methods of Absorption, Adsorption, Condensation, Chemical Transformation, Cyclone Separation And Electrical – Magnetic Separation. Analysis And Characterization of Gaseous Pollutants, Air Pollution Monitoring Instruments: Principle; Mechanical Collectors, Bag Filters.
- Unit III** Definitions of Pollutant Concentrations And Relationship Between These Concentrations, Smoke And Its Control, Dust And Solid Particulates, Nighalman Smoke Chart, Smoke Prevention And Control, Air Pollution Control By Process Absorption And Adsorption. Design of Air Pollution Control Equipments: Cyclone Separator, ESP, Gravity Settling Chamber, Wet Scrubbers, ESP; Advantages And Disadvantages of ESP; Chimney Height, Plume Dispersion of Smoke In Atmosphere, Integrated Air Pollution Control System.
- Unit IV** Air Pollution Indices, Definition of Air Pollution Indices, Type And Use of Air Pollution Indices. The Standardized Indices And Its Criterion Air Pollution Legislation And Regulations, Pollution Board & Its Function, Duties And Power of State And Central Boards of Pollution, Air Pollution Act 1981 And Its Amendment.
- Unit V** Air Pollution And Its Control In: Fertilizer Industries, Cement Industries, Paper Industries, Refinery, Mining And Metallurgical Industries. Automobile Emission Control And Remedies, Thermal Power Plant Pollution And Its Control.

**Text Books:**

1. Air Pollution – M.N. Rao
2. Industrial Pollution Control – W.W. Eckenfelder
3. Air Pollution Control Theory – Martin Crewford

**Reference Books**

1. Hand Book of Air Pollution Engineering – S. Clavert & H.M. Englund
2. Air Pollution Control Technology – R.M. Betheaven Van Nosterd

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
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**Semester: M.E. Ist**

**Branch: Chemical Engg.(Environmental Engg.)**

**Subject: Environment System Optimization**

**Code: 530113(19)**

**Total Theory Periods: 40**

**Total Tutorial Periods: 12**

**Total Marks in End Semester Exam: 100**

**Minimum number of class tests to be conducted :02**

- Unit I** Formulation and Analysis of Environmental Systems, Mathematical Modeling And Optimization, Optimization And Algorithms Methods Of Lagrange Multipliers, Unconstrained And Constrained Optimization, Sequential Search Algorithm.
- Unit II** Box' s Algorithms; (Linear Programming Models; Simplex Method Separable And Integer Programming).
- Unit III** Transportation Models Dynamic Programming Models & Their Applications.
- Unit IV** Water Supply And Wastewater Collection Systems and Its Applications.
- Unit V** Agriculture Non-Point Source Pollution Problem, Air Pollution Control, And Management Systems, Solid Waste Collection.

**Text Books:**

1. D.A. Haith, Environmental systems optimization, John Wiley 1982
2. S.S. Rao, optimization Theory and application, Wiley Eastern, 1978

**Reference books:**

1. Reible D.D., Fundamentals of Environmental Engineering, Lewis Publishers, 1999.
2. Edgar Himmalblau, Chemical Process Optimization.

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

**Semester: M.E. Ist**

**Branch: Chemical Engg.(Environmental Engg.)**

**Subject: Water Pollution Control**

**Code: 530114 (19)**

**Total Theory Periods: 40**

**Total Tutorial Periods: 12**

**Total Marks in End Semester Exam: 100**

**Minimum number of class tests to be conducted :02**

Note: Internal choice may be given in any three units.

- Unit I** Waste Water: Industrial Wastewater – Characterization, Treatability Studies, Segregation, Battery Limits Treatment, and Pretreatment, Control of Pollutants.
- Unit II** Municipal Sewage: Definition of Sewage Water Carriage System, Cross –Sections And Classification of Sewers; Sewage Treatment: Various Processes: Preliminary, Primary. Secondary Treatment, Attached And Suspended Growth Processes, Activated Sludge, Sludge Digestion, Septic Tank, Imhoff Tank, Oxidation Ponds.
- Unit III** Industrial Waste Water Treatment & Design of Equipments: Coagulation, Sedimentation, Thickening, Precipitation, Biological Oxidation, Biomethanation, Adsorption, Ion Exchange, Membrane Separation, Chemical Oxidation, Sludge Dewatering And Disposal Methods..
- Unit IV** Control of Water Pollution From Organic Chemicals: Refinery, Petrochemical, Distillery, Pulp And Paper, Textile Fertilizer, Tanneries, Food And Pharmaceutical Industries, Coke Ovens And Steel Plants.
- Unit V** Wastewater Disposal: Disposal By Dilution Factors Affecting Self-Purification of Polluted Streams, Oxygen Sag Curve, Disposal on the Surfaces.

## **Text Books:**

1. Water and waste water Technology ,Marks and Hammer.
2. Water and waste water Treatment, Humenick M.J. (Mc Graw Hill)
3. Wastewater Engineering, Metcalf and Eddy.

## **Reference books:**

1. Waste water Treatment for pollution control, Areeivala S.J. (Tripathi private Ltd)
2. Industries pollution control, W.W. Eckenfelder (Mc Graw Hill)

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

**Semester: M.E. Ist**

**Subject: Energy & Environment**

**Total Theory Periods: 40**

**Total Marks in End Semester Exam: 100**

**Minimum number of class tests to be conducted :02**

**Branch: Chemical Engg.(Environmental Engg.)**

**Code: 530131 (19)**

**Total Tutorial Periods: 12**

Note: Internal choice may be given in any three units.

**Unit I:** Principles And Sources of Energy Conversion Methods: Thermal, Nuclear, and Solar; An Introduction to Fuels: Combustion Fundamentals, Thermodynamics of Combustion Rates And Properties of Combustion Products, Formation of Pollutants, Measurement And Control,

**Unit II:** Fundamentals of Engine Processes, Sources of Emissions From Automobiles, Effect of Operating And Design Parameters on Emission, Recent Trends in Design of Non-Polluting Power Units, Control Methods, Exhaust Reactor Problems And Prospects.

**Unit III:** Exhaust Emission Test Procedures, Standards And Legislation. Combustion in Stationary Sources, Power Production, Co-Generation; Alternative Energy Sources: Utilization, Economics, Environmental Impact And Management.

**Unit IV:** Classification of Various Energy Sources, Renewable And Non-Renewable Energy Sources, Remedial Measure to Energy Crises, Energy Conservation, Laws of Energy Efficiency.

**Unit V:** Energy Audit, Bio Energy, Biogas Plant And Their Operation, Biomass And Its Conservation Route to Gaseous And Liquid Fuel, Its Potential And Generation By Wind Mills.

**Text Books:**

1. A.M. Kanury: Introduction to combustion phenomena, Gordon and beach science publishers.
2. E.Starkman: Combustion generated air pollution, Plenum Press

**Reference books:**

1. J.M. Fowler: Energy and the Environment, McGrawHill
2. G.D. Rai: Non-Conventional energy sources.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

**Semester: M.E. Ist**

**Subject: Natural Resource Management**

**Total Theory Periods: 40**

**Total Marks in End Semester Exam: 100**

**Minimum number of class tests to be conducted :02**

**Branch: Chemical Engg.(Environmental Engg.)**

**Code: 530132 (19)**

**Total Tutorial Periods: 12**

Note: Internal choice may be given in any three units.

- Unit I** Land Resources: Land Evaluation And Suitability Studies By Remote Sensing And G.I.S. Techniques of Land Use/Land Over, Map Preparation, Land Use/Land Over Mapping And Planning.
- Unit II** Land Use Statistics As Basis For Environmental Planning, Solid And Hazardous Waste Disposal Site Selection.
- Unit III** Geosciences: Role of Remote Sensing And GIS in Geological Studies And Case Studies, Ground Water Exploration And Targeting Using GIS.
- Unit IV** Water Resources: Watershed Characteristics, Water Shed Management And Integrated Management For Sustainable Planning Using GIS.
- Unit V** Water Quality Management: Case Studies and System Modeling for Surface and Groundwater.

**Text Books:**

1. Introduction to environment remote sensing, Barredd, Chapman and hall.
2. Remote sensing and image interpretation, Lillesand and Lifwer, JohnWiley Publication.

**Reference books:**

1. Remote sensing in geology, Siegal, John Wiley Publication
2. Remote sensing and hydrology, Engman, Chapman and hall

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

**Semester: M.E. Ist**

**Subject: Introduction to ANN & Ex. Sy.**

**Total Theory Periods: 40**

**Total Marks in End Semester Exam: 100**

**Minimum number of class tests to be conducted :02**

**Branch: Chemical Engg.(Environmental Engg.)**

**Code: 530133 (19)**

**Total Tutorial Periods: 12**

Note: Internal choice may be given in any three units.

- Unit I**          Neural Network: Characteristics of Neural Network, Comparison of Computer And Biological Neural Network, Network Architecture, ANN Terminology.
- Unit II**          Learning Process: Error Correction, Memory Base, Hebbian Learning And Different Other Learning Method. Different ANN Model For Pattern Recognition Problem.
- Unit III**          Perceptron: Single Layer Perceptron, Multilayer Perceptron, Back Propagation Algorithm, Radial Basis Function Network, Generalization And Regularization Methods of A Neural Network System. Application of ANN in Chemical Industry.
- Unit IV**          Various training methods, Linear Filters, Validation of experimental data using ANN in a MATLAB platform. Prediction of process parameters by simulating the data through ANN.
- Unit V**          Expert system: Introduction of expert system, comparison with ANN, Application of Expert System in Chemical Industry.

**Text Books:**

1.          Artificial Neural Network – B. Yagnanarayana
2.          Neural Network Design – Martin T. Hagan, Howard, B.Pemuth

**Reference Books:**

1.          Introduction to Neural Network – Simond Haykin



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**Semester: M.E. Ist**

**Branch: Chemical Engg.(Environmental Engg.)**

**Subject: Air Pollution Control Lab**

**Code: 530121 (19)**

**Total Practical Periods: 40**

**Total Marks in End Semester Exam: 75**

**Experiments to be performed:**

1. Sampling, Analyses & Comparisons of Various Air Pollutants from Ambient and from Artificial Sources.

**List of Equipments/Machines Required:**

1. Ringelmann's chart
2. Dust Fall Jar
3. Gas Chromatograph
4. High Volume Sampler
5. Sampling Kit's
6. Orsat's Apparatus, etc.

**Recommended Books:**

1. Air Pollution by – M.N. Rao
2. Industrial Pollution Control – W.W. Eckenfelder
3. Air Pollution Control Theory – Martin Crewford

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
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**Semester: M.E. Ist**

**Branch: Chemical Engg.(Environmental Engg.)**

**Subject: Water Pollution Control -Lab**

**Code: 530122 (19)**

**Total Practical Periods: 40**

**Total Marks in End Semester Exam: 75**

**Experiments to be performed:**

1. To perform MPN Test for a given sample.
2. Analysis of wastewater for various parameters.
3. Analysis of potable water for various parameters.
4. Aerobic digestion of wastewater & BOD reduction calculation with organic loading.
5. Anaerobic digestion of wastewater sample with organic loading.
6. C.O.D. analysis of wastewater sample.
7. To determine the concentration of the given water sample by Photoelectric Colorimeter.
8. To determine the concentration of the given water sample by UV-VIS Spectrophotometer.
9. To detect the presence of alkali metals in the given water sample using Flame Photometer.

**List of Equipments/Machines Required**

1. Refractometer
2. TDS Meter
3. Conductivity meter
4. Portable water analysis kit
5. Digital pH Meter
6. Photoelectric Colorimeter
7. UV-VIS Spectrophotometer
8. Flame Photometer
9. BOD Incubator

**Recommended Books:**

1. D.Ekman, Instrumentation.