Program of:
Science and Technology of Sugar Industry Diploma
(Environmental Section)
(Program Scheme and Courses Content)
Program of: Science and Technology of Sugar Industry Diploma
(Environmental Section)

First Year: First Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>No. H.</th>
<th>Prac. H.</th>
<th>Exams Y.W.</th>
<th>Wr.</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN5101</td>
<td>Environmental chemistry.</td>
<td>2</td>
<td></td>
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<td>EN5102</td>
<td>Chemical Industries Based on Sugar Industry.</td>
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<td>EN5103</td>
<td>Company Laws and Work Legislation</td>
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<td>EN5104</td>
<td>Environmental economics</td>
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<td>EN5105</td>
<td>Language</td>
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<td>EN5106</td>
<td>Environmental law, ethics and policy</td>
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</table>

* Elective Courses (A)
Choose one from the following:

- EN5107 Water and Wastewater engineering.
- EN5108 Advanced Analytical Chemistry.
- EN5109 Corrosion Control.

** Elective Courses (B)
Choose one from the following:

- EN5110 Air pollution and climate change
- EN5111 Biodiversity and conversion
- EN5112 Restoration ecology

*** Extended courses

Note:

Course Code Description:

Course Name: AB CDEF

(AB): is an indicator for the diploma name.

(C) : is a number for graduate course level (from 1 to 4).

(D) : is a number indicating the semester number.

(EF): is a number indicating the serial number of the course during the semester.
## Program of: Science and Technology of Sugar Industry Diploma
(Environmental Section)

### First Year: Second Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>No. H.</th>
<th>Prac. H.</th>
<th>Exams Y.W.</th>
<th>Wr.</th>
<th>Grade</th>
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<tbody>
<tr>
<td>EN5201</td>
<td>Environmental biology</td>
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<td>EN5202</td>
<td>Technology of Sugar Industry (I.)</td>
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<td>EN5203</td>
<td>Pollution Control in Sugar Factories</td>
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<tr>
<td>EN5204</td>
<td>EIA and environmental auditing.</td>
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<td>EN5205</td>
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<td>EN5206</td>
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</table>

*Elective Courses (A)
Choose one from the following:
- EN5207 Environmental pollution: water and soil
- EN5208 Sugar industry solid waste treatment
- EN5209 Statistical and research methods

**Elective Courses (B)
Choose one from the following:
- EN5210 Environmental geosciences.
- EN5211 Economic and Management of Sugar Factories
- EN5212 Pulp and paper industry waste control

***Extended courses
<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>No. H.</th>
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<th>Exams Y.W.</th>
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<td>EN5301</td>
<td>Chemical Control in Sugar Factories</td>
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<td>EN5303</td>
<td>Technology of Sugar Industry (II)</td>
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<td>EN5304</td>
<td>Environmental laboratory (I)***</td>
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<td>EN5305</td>
<td>Computer Programming.</td>
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<td>EN5306</td>
<td>Environmental toxicology, health and safety</td>
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* Elective Courses (A)
Choose one from the following:

- EN5307 Standardization in the sugar industry
- EN5308 Computer Systems and Performance Evaluation.
- EN5309 Watershed management

** Elective Courses (B)
Choose one from the following:

- EN5310 Environmental planning and management
- EN5311 Instrumental analysis
- EN5312 Plant Equipment Planning.

*** Extended courses
Program of: Science and Technology of Sugar Industry Diploma
(Environmental Section)

**Second Year: Second Semester**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>No. H.</th>
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<th>Exams Y.W.</th>
<th>Exams Wr.</th>
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<tr>
<td>EN5401</td>
<td>Quality Control in Sugar Factories.</td>
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<td>EN5402</td>
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<tr>
<td>EN5403</td>
<td>Marketing and market economics</td>
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<tr>
<td>EN5404</td>
<td>Environmental laboratory</td>
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<td>EN5405</td>
<td>Statistical Analysis.</td>
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<td>EN5406</td>
<td>Industrial waste management</td>
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<td>255</td>
<td>495</td>
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</tbody>
</table>

*Elective Courses (A)
Choose one from the following:

EN5407 Chromatographic Analysis.
EN5408 Quality and Management.
EN5409 Process Control Engineering.

**Elective Courses (B)
Choose one from the following:

EN5410 Design of Industrial Waste Treatment System.
EN5411 Microbial toxins
EN5412 Marketing Research.

EN5413 Project Economics.

***Extended courses
First Year: First Semester

EN5101- Environmental Chemistry: (2 h/w)

1. Concept and Scope of Environmental Chemistry: Definition and explanation for various terms, segments of environment. Principles and cyclic pathways in the environments
2. Chemistry of Biologically Important Molecules: Chemistry of Water: Unusual physical properties, hydrogen bonding in biological systems, unusual solvent properties, changes in water properties by addition of solute. Protein structure and biological functions, enzymes, enzyme metabolism, biosynthesis of DNA and RNA, mutations and Gene control during embryogenesis.
4. Hydrocarbons: Chemistry of hydrocarbon decay, environmental effects, effects on macro and microorganisms.
5. Surfactants: Cationic, anionic and nonionic detergents, modified detergents.
6. Pesticides: Classification, degradation, analysis, pollution due to pesticides and DDT problems.
7. Synthetic Polymers: Microbial decomposition, polymer decay, ecological and consideration, Photosensitize additives.
9. Aflatoxin occurrence, chemical composition and properties metabolism, acute toxicity, carcinogenicity.
10. Destruction of some hazardous substances: Acid halides and anhydrides, alkali metals, cyanides and cyanogens bromides, chromium, aflotoxins, halogenated compounds.
11. Principle, merits and demerits of the techniques – Neutron Activation Analysis, isotope dilution analysis, calorimetric, colourimetry, Atomic Absorption Spectroscopy, Gas chromatography, HPLC, Ion exchange Chromatography and Polarography. XRF, XRD etc.
12. Stoichiometry, Gibb’s energy, Chemical potential, chemical equilibria, acid base reactions, solubility product, solubility of gases in water, the carbonate system, radionuclides.

References:
2. Elements of Environmental Chemistry : H.V. Jadhav.
5. Destruction of hazards chemicals in the laboratory : G. Lunn and E.B. Sansone.
8. Instrumental Methods of Analysis : Chatwal and Anand.
12. Environmental Pollution Analysis : Khopkar.

EN5102- Chemical Industries Based on Sugar Industry: (2h/w)

1- Ethyl alcohol perfumes industry.
2- Formic acid industry.
3- Acetic acid industry.
4- Butyric acid industry.
5- Citric acid industry.
6- Glycerol industry.
7- Butyl alcohol industry.
8- Acetone industry.

EN5103- Companies Laws and Work Legislations: (2h/w)

1- Law of work .
2- Individual and group work contracts .
3- Decrees of syndicates and companies .
4- Delimitations of employing delinquents and women, foreigners working for Egyptians and Egyptians working for foreigners.
5- Arabic and international work agreements.
6- Law of social insurance.
7- Kinds of social insurance.
8- Study of decrees related to special kind of social insurance.
9- Distinguishing between decrees of social insurance and other kinds of Insurance.

EN5104- Environmental Economics: (2 h/w)

1. The Economy and the Environment: Two Parts of a Whole – Inter linkages between the economy and the environment.

3. Economic Instruments for Environmental Protection: Command & Control versus Incentives and Subsidies - Available Policy Options - Effectiveness of these instruments, International Comparisons.


5. Economic Growth and the Environment: Environmental Kuznets’ curve, Foreign Direct Investment Inflow and the Environmental quality


7. Climate Change and India: Vulnerability of regions and populations – Adaptation options.

**Texts/References:**


**EN5105- Language:** (2 h/w)

1. Introduction.
2. Characteristics of the technical English.
4. Active sentences and its characteristics.
5- Some of the common errors in writing technical English sentences.

6- Phrasing: (Main idea – Methods of explaining the main idea – Types of phrases – Reading and analyzing some of the technical writing to develop the communication skills).

Note: This Course of Language is to be taught to all specialties

**EN5106- Environmental Law, Ethic and Policy: (2 h/w)**


References:
2. Anti – Pollution Acts (3) and Commentaries published theorem.UoP, revised M.Sc. (Env.Sci.) Syllabus -2008-09
5. P. Leelakrishnan, Environmental and the last (Bullorthworths, Latold, edn.).
6. Basic environmental technology: Jerry; A. Nathanson.
9. ISO 14004 – Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004: 1996 (E)).

EN5107- Water and Wastewater Engineering: (2 h/w)

1. Water engineering: Water Requirements for Domestic Consumption. Population forecasting by the following methods. Demographic method, Arithmetical progression method, Geometrical progression method, Logistic methods, Graphical projection method, Final prediction. Quality of water required for followings.(a) Domestic - (b) Institutional (Schools, Hostels, Hospitals) - (c) Fire fighting - (d) Commercial (Shopping complex, Hotels, Restaurant) - (e) Industrial (Dairy, Sugar, Pulp and Paper, etc.) (f) Specific requirement at pilgrimage place and recreation activities.
2. Impact of future growth and development and change in quality of life on water requirement.
3. Types of solid in water and their impact on water quality.
5. Specifications for drinking water (physical, chemical & bacteriological) by Bureau of Egyptian Standards & World Health Organization. Packaged drinking water.
6. Water Sources – Availability & quality of Surface water (River, stream lake, dam) & Ground water (Open well & Bore well)
8. Inter-relations between water source, quality of raw water, solids in water & treatment process.
9. Selection of appropriate unit operations for the treatment and flow chart of water treatment plant.
10. Wastewater engineering for Preliminary & Primary Treatment: Quantity & Quality of sewage generated, Impact of Future growth & development & change in quality of life on sewage quality & quantity.
15. Different model of anaerobic digestion by combination of attached & suspended growth.
References:
3. Waste water engineering, Met Calf &Eddy ;INC, Tata mc Graw Hill.
5. Waste water treatment for pollution control, Dr. Arceivala, Tata McGrawHill.
6. Indian standard for drinking water, BSI, New Delhi.

EN5108- Advanced Analytical Chemistry: (2h/w)
- Introduction.
- Treatment of analytical data.
- Acid-base titrationin non-aqueous solvents.
- Analytical applications of precipitation reactions.
- Analytical applications of oxidation-reaction reactions.
- Methods of separation.
- Applications of solvent-solvent extraction.
- Application of solvent-solid extraction.
- Classical methods in environmental analysis.

EN5109- Corrosion Control: (2h/w)
1- Principles of corrosion.
2- Electrochemical characteristics, (electrochemical reactions, polarization and passivity).
3- Environmental effects.
4- Forms of corrosion.
5- Anodic and cathodic protection.
6- Corrosion inhibitors.
7- Inhibition and environments.

EN5110 – Air Pollution and Climate Change: (2 h/w)

Air Pollution:
Composition of Air, Chemical composition of atmosphere, Reactions in
troposphere, stratosphere, mesosphere and ionosphere

Classification and effect of air pollutants:
Classification of air pollutants, sources, effects of pollutants Particulates,
NOx, SOx, and Oxides of Carbon and hydrocarbons, wet and dry
deposition on plants, animals and properties, acid rains

Vehicular Pollution:
Automobile emissions, dispersion of vehicular pollutants, carcinogenic
potential of the automobile exhaust, prevention and control of vehicular
pollution, alternative fuels, SPM pollution, path of a particulate particle,
lead pollution, methyl tertiary butyl ether pollution through different
technologies.

Greenhouse effect:
Green house gases and their major sources, greenhouse effect and climate
change, global temperature global warming and its effects agriculture,
health and monsoon pattern

Aerosols:
Sources of aerosols, classification and size of aerosols, adverse effects of
aerosols, aerosols and health, cloud seeding

Industrial Air Pollution:
Point and non-point sources of air pollution, Principle causes of industrial
pollution, environmental problems of some industries, thermal power
plants and pollution, nuclear power plants, agro based industry, pulp and
paper industry, plastic industry, mining and metallurgy industry, cement
industry, Preventive measures of industrial pollution.

Ozone layer – the Earth’s umbrella –
Creation of ozone layer, formation of ozone, mechanism of ozone
depletion, Null and Holding cycles, Antarctic and arctic ozone hole
formation, effects of ozone depletion, CFC and Ozone depletion,
Montreal Protocol

Analytical methods for air quality analysis:
Air monitoring instruments and technique, Monitoring of sulphur dioxide
by different methods, monitoring of NOx, CO, hydrocarbons, SPM, trace
metals.

Prevention and control of air pollution through different
technologies:
Control of air pollution by fuel selection and utilization through process
modification with examples, General methods of air pollution control: zoning, air pollution

**Equipments for Control of air pollution: Principle and working of following**

Control of particulate matter, **Cyclones** – cyclones and inertial separators

**Wet scrubbers** – wet scrubbing basics, types of wet particulate collectors, venturi scrubber, spray tower, cyclonic scrubber, plate and tray scrubber

**Electrostatic precipitators** – types of ESP, **Fabric filters** – Fiber types, media selection, shaker cleaning, reverse air cleaning, pulsejet cleaning

Control of gaseous pollutants - **Absorption** - packed column, Adsorption, Condensation, Vapor incineration

**Climate Change and Clean Development Mechanism:**

IPCC (Intergovernmental Panel on Climate Change), UNFCCC (United Nations Framework Convention on Climate Change), Kyoto Protocol, Clean Development Mechanism, Carbon sequestration, carbon trading, Certified emissions reduction, Green House Effect, Global Warming

**Suggested Readings:**

1. Environmental chemistry by B.K. Sharma Goel publishing house, Meerut.
4. Air Pollution Control by CP Mahajan, Capitol Publishing Co
7. Environmental Engineers Handbook by David Liu and BelaLiptak
9. Text of the Kyoto Protocol on www.unfccc.int
10. Clean Development Mechanism by Winrock International, India
11. Environmental Meteorology by B. Padmanabhan Murthy

**EN5111- Biodiversity and Conservation: (2 h/w)**

**Introducing Biodiversity and its assessment:**

Introduction, Concept, Definition, Aims and objectives, need for assessment, Scope of Biodiversity Science

**Characterization of Biodiversity:**

Introduction, need for characterization, various disciplines of Biodiversity-Evolutionary, taxonomic, Ecology, Genetics, Population,
composition and levels of biodiversity, Ecological, Organismal, genetic and cultural diversity, alpha-Beta-Gama diversity, process of diversification at genetic and species level

**Magnitude and distribution of biodiversity:**
Introduction, Distribution: Geographical pattern, Gradients, Centers of diversification, introduced species, domestication and rarity, biodiversity patterns, environmental factors, ecological theories of species diversity, endemism and biodiversity,

**Biodiversity Loss:**
Loss of Species and Genetic Diversity: Introduction, Factors causing loss of species and genetic diversity, Founder Effects, Demographic bottlenecks, Genetic Drift, Inbreeding Depression, IUCN Threatened species Categories
Loss of Ecosystem Diversity: Factors Affecting Ecosystem Degradation & Loss

**Reasons for Loss in Diversity of Major Ecosystems of the World**
Loss of Agro-biodiversity, Loss of Biodiversity as an Economic Process

**Biodiversity and Ecosystem Functioning:**
Introduction, biodiversity and ecosystem services, functional properties of biodiversity, drivers and dynamics of changes in biodiversity, ecosystem analysis

**Inventorying and Monitoring of Biodiversity:**
Introduction, Necessity, scales, planning and approaches to inventorying and monitoring, integrated approaches, capacity building.

**Management of Biodiversity**

**Data and information management:**
Introduction, nature and uses, data collection and management, tools and techniques, sources, legal aspects, institutional capacity development

**Biotechnology:**
Introduction, Biotechnology and its Role in Assessment of Biodiversity and Bioresources, Conservation, and Utilization. Adverse Impacts of Biotechnology on Biodiversity: Direct Impacts, Indirect Impacts
Economic value of Biodiversity:
Introduction, Biodiversity Values, Ethical and Aesthetic Values, use and nonuse values

Conservation of Biodiversity:

Biodiversity Prospecting and Indigenous Knowledge Systems:
Bioprospecting, Indigenous Knowledge Systems, Bio-piracy/PR’s and Ownership of Traditional Knowledge, Traditional Resource Rights Problems and Prospects in Participatory Management of Biodiversity

Readings:
- Biodiversity and Conservation (2005), Michael J. Jeffries, Routledge, London
- Forest Genetic Resources: Status, Threats and Conservation Strategies (2001), Uma Shaanker, R. Ganeshiah, KN. and Bawa KS (Eds); Oxford and IBH, New Delhi
- Global Biodiversity: Status of the Worlds Living Resources (1992); WCMC; Chapman and Hall, London
EN5112 Restoration Ecology (optional): (2 h/w)

 Restoration Ecology: Definition, Concept. Role of basic ecological principles and restoration ecology: biotic and a biotic interaction, ecological succession, role of pioneer species in restoration.


 Restoration degrade aquatic ecosystems: role of plants and microbes. Restoration of riverine and coastal ecosystems, Wastewater treatment using constructed wetlands.

 Watershed Management: Introduction to watershed, concept and significance. Physical characteristics of watershed. Hydrological characteristics of water shed. Land-use and land-cover classification, resource appraisal.

 Water and soil conservation measures: Drain-line treatment; Area treatment-Goals, features and watershed as unit of sustainable development. Selection of plant species for plantation. Organic farming and organic fertilizers.

 Social Institutions: Gram-Panchayat, Self-help Groups for Women, Farmer. Managed small-scale irrigation systems (cooperative – Lift-irrigation); Watershed Development Committees.


 Agro-forestry systems: (a) Classification; (b) Agrosilvopastoral systems; (c) Silvopastoral systems; (d) Land Agroforestry. Silviculture, (a) Role of exotics; (b) Ethnosilviculturalrefugia. horticulture and pastureland

 Suggested Readings:
 - Bradshaw; Restoration of wastelands
 - Wasteland Development – Khan, et al.,
 - Forestry – Segreiya : Champion and Seth.
 - Watershed Manual by Bharat Kakade (BAIF, Pune)
EN5201- Environmental Biology: (2 h/w)


2. Environmental Microbiology: Microbes – classification and their applications in the environmental sciences. Cultivation and growth of microorganisms. Microorganisms and their association with man, animals and plants. Microbes as anti-microbial agents, Extremophilic microorganisms, Microbial metabolism

3. Biomes and Habitat Diversity: Classification of biomes, major biotic elements of each biome and their characteristics.

4. Biological diversity of India: Definition and nature, Egypt's biogeographically history, physiography, climate and its impact on biodiversity. Indian forest and vegetation types and diversity of flora and fauna.


9. Wildlife management and conservation. Protected Areas Network in India: Goals of management, Strategies for planning. Factors influencing wildlife management such as habitats, population, behavior, food-habits, health, etc., tools for data collection and analysis. Human land-use and wildlife management units, important projects for the conservation of wildlife in India, Role of local communities in wildlife management.


11. Biodiversity conservation: Global agreements and national concerns. RAMSAR sites, CBD, Quarantine Regulations, National Forest Policy, Biodiversity Act., Wild-life Protection Act
References:

EN5202- Technology of Sugar Factories (I): (4h/w)

1- Juice clarification and purification of impurities and non sugar substances which adverse crystallization process.
2- Chemical and physical properties of cane juice
3- Methods of clarification
   a- Use of lime solution and P₂O₅ (Source of P₂O₅ is tricalcium phosphate).
   b- Use of lime solution and CO₂ purified to produce active calcium carbonate.
   c- Details of chemical reactions in each method.
   d- Advantages and disadvantages of each method.
   e- Sulphonation of syrup.

4- Refining of Egyptian raw sugar and imported sugar.
   a- Affination of raw sugar to remove films of non sugar from crystal Is using centrifuges and dessaliring sugar.
   b- Chemical treatment using lime and CO₂ (carbonation).
   c- Chemical reactions included and factors affecting it.
   d- Purification of CO₂ and its chemical neutralization.
   e- Use of phosphatation method to clarifying sugar soluble solution.
   f- Decolouration of sugar soluble solution by bonechar activated carbon, resins - advantages and disadvantages of each method.
   g- Boiling system in refining factories.

EN5203- Pollution Control in Sugar Factories: (2h/w)

1 - Sources of air pollution and emissions.
2 - Environmental impact of air pollution.
3 - Thermodynamics, chemical kinetics and air pollution.
4 - Meteorology and natural purification processes.
5 - Engineered system for air pollution control.
6 - Particles, its measurements and control.
7 - Measurements and analysis of air pollutants.
8 - Sources and control of water pollution in sugar industry.
9 - Engineered system for water pollution control.

EN5204- EIA and Environmental Auditing: (2 h/w)

Introduction: Environmental Assessment process, objectives of EIA, Terminology, Hierarchy in EIA, Historical Review of EIA, Concepts related to EIA, Basic data collection for EIA
Legislation and Procedures: National Environmental Policy Act and Implementation, EIA legislative requirements and administrative procedures in India/Indian States, EIA notification 2006
Techniques and Methodology: Description of the environmental setting, Methods of Impact Analysis, Environmental risk assessment, baseline data collection for EIA
Public Participation in environmental decision making, regulatory requirement, techniques, advantages and disadvantages of public participation
Preparation and writing of EIA report
Prediction and Assessment of Impacts on Air, Water, Noise, Biological, Cultural and socio-economic Environment, Mining, blasting
Case studies of EIA for Industries like Oil, Petrochemical, iron and steel, fertilizer, sugar and distillery, projects of road/dams and housing etc.
Environment Management Plan: Planning, selection of appropriate procedures, Introduction to Environmental budget, to minimize environmental Impacts
Environmental Audit: Definition of Environment Audit and its importance for industries. Types of audits, General audit methodology and basic structure of audit. Elements of an audit process and its importance. Concept of ISO14000

Suggested Readings:

EN5205- **Technical Writing:** (2h/w)

1- Elements of technical reports.  
2- Methods of engineering writing.  
3- Methods of analyzing the engineering data.  
4- Correct expressions and analytical reading.  
5- Report of projects.  
6- Report of experiments.  
7- Assignment reports.

*Note:* This Course of Technical Writing is to be taught to all specialties.

EN5206- **Environmental Management Systems:** (2 h/w)

Environmental Management 
Fundamentals of environmental management, international standards in environmental management. Background and development of the ISO 14000 series of standards. EMAS- European Union

Environmental Management Systems 
Definition and scope, Goals and purposes of EMS, Planning, Implementation, Review and Improvement (Plan, do, check, act model), Benefits of EMS Environmental benefits, economic benefits, Costs associated with EMS

Life Cycle Analysis 
Definition, Goals and purpose, Stages in product LCA, Procedure for LCA defining the goal and scope, analyzing the inventory, assessing the environmental impact and evaluating the environmental profiles, LCA uses and tools, Variants of LCA- cradle to grave, cradle to gate, cradle to cradle, gate to gate, well to wheel, Benefits and limitations of conducting LCA

Environmental design 
Principles, benefits, motivation, ED for manufactured products, ED for buildings ED for developmental planning

Solid Waste Management 
Properties of solid waste material, types of solid waste- industrial, domestic, agricultural Health impacts due to solid waste treatment.

**Municipal Solid Waste management with reference to India**
Generation, Collection, Composition, Transportation, Transfer stations, Recycling of components and processing of MSW, Ultimate disposal,
Assessment of existing situation, Possible areas for improvement.

**Disposal and Treatment of solid waste:**
Engineering principles of solid waste disposal techniques, Pyrolysis and incineration, composting and hydrolysis, sanitary landfill, disposal at sea.

**Hazardous solid waste:**
Types and characteristics, biomedical and industrial. Criteria used in identification of hazardous waste site, development and management.

**Suggested readings:**
3. A K Mhaskar, “Matter hazardous”, Enviromedia
5. Goerge Tchobanglous, “Solid Waste Engineering: Principles and management issues”
6. C S Rao, “Environmental Pollution Control Engineering”

**EN5207- Environmental Pollution-I: Water and Soil: (2 h/w)**

1. Freshwater Pollution: Types and sources. Sampling Methods. a. Water Quality Parameters, b. Types and sources of water pollution, Various pollutants responsible for water pollution: Biological pollutants; Inorganic; Organic; Heavy metals; Pesticides; Radioactive pollutants, etc. c. Various sources Effluent standards, Drinking water standards, Characteristics of Domestic Waste, Characteristics of agricultural Waste, e. Consequences of water Pollution: Effect on health on biosphere and on economy, f. Sampling methods: Purpose of sampling, different types of samples, collection methods and various instruments used for it. g. Methods involved in estimation of parameter for pollution levels.

2. Marine Water Pollution: Types, sources and consequences. Specifications for disposal of sewage and industrial waste into sea. Disposal of sewage & wash water from MVcargo & ships

restoration of land due to a. disposal to fly ash, b. dumping overburden & tailing in iron ore extraction.


References:

EN5208- Sugar industry solid waste treatment: (2 h/w)

7- Process Description of Sugar Industry:
8- Sugar Crystal Separation, Drying, Packing and Molasses Handling
9- Water Requirement of a Sugar Industry:
10-Wastewater Characterization of a Sugar Industry:
11-Wastewater Treatment of Sugar Industry:
12- Conventional Treatment Method:
13- Modern treatment methods
14- Effluent Treatment Plant in a Sugar Industry
15-Solid Waste Problem Arising in Sugar Industry:
16- Bagasse Reuse:

References:
1- Sugar Industry: Process Description and Wastewater Treatment

EN5209 - Statistical and Research Methods: Theory and practical's: (2 h/w)

1. Sampling, Data collection and recording.
2. Central tendency – concept; arithmetic mean, mode, median for ungrouped and grouped data.
3. Measures of dispersion: absolute and relative measures; range, standard deviation (grouped and ungrouped data), variance, quartile deviation, coefficient of variability. Skewness, Kurtosis
4. Probability - normal, poisson and binomial
6. Distribution- Normal, t and chi square test
8. Matrices, simultaneous linear equations; tests of hypothesis and significance.
9. Time series analysis - moving averages (3 and 5 unit cycles)
10. Current development in the subject

References:

EN5210 – Environmental Geosciences: (2 h/w)

1. Atmosphere: Earth's.

4. Temperature measurements and controls, Environmental lapse rate, dry and wet adiabatic lapse rate, inversion of temperature and atmospheric stability.

5. Atmospheric pressure and winds: Pressure measurements and distribution; Wind observation, measurement, factors affecting wind; geostrophic wind and gradient wind, local winds, model of general circulation of the atmosphere, Jet stream.

6. Atmospheric moisture: Forms of condensation; Precipitation, Hydrological cycle.

7. Atmospheric disturbances: Thunderstorms, Cyclones, lightening, flood, and drought.

8. **Earth science:** Internal structure of Earth, Geological evolution, Rocks and their classification, minerals and their classification. Weathering and soil formation, soil profile, soil classification, soils of India.


**References:**

**EN5211- Economic and Management of Sugar Factories:** (2h/w)

1- Principles and rules of production economics determining the use of agricultural resources in sugar-cane production.

2- Economic and productive efficiency of raw sugar industry.

3- Riske and uncertainty of sugar-cane production.

4- Economic of scale.

5- Technological changes of raw sugar industry.
6- Planning of raw sugar factories - using some of operations research tools, such as linear programming method and transportation models.
7- Practical and applied management of raw sugar factories.
8- Economic feasibility study of raw sugar factories and its financial analysis.

**EN5212- Pulp and paper industry wastes management: (2 h/w)**

1- Overview of Pulp and papermaking processes (4 hours).
2- Environmental issues of pulp and paper industry (2 hours).
3- Emissions from pulp and papermaking (2 hours).
4- Generation of waste in pulp and paper mills (4 hours).
5- Composition of waste (2 hours).
6- Pretreatment of sludge (2 hours).
7- Alternative management of pulp and paper industry solid wastes (6 hours).
8- New technology for energy recovery from sludge (6 hours).

**References:**

**EN5301- Chemical Control in Sugar Factories: (2h/w)**

1- Definitions and expressions used in sugar factories.
2- Weights and measurements.
3- Description and usage of equipments.
4- Sampling methods.
5- Reagents.
6- General analytical methods, products analysis and calculation methods.
7- Chemical reagents used in chemical analysis.
8- General analytical methods.
9- Analytical methods of different products in sugar manufacture.
10- Calculation methods used in chemical analysis in sugar manufacture.

**EN5302- Research Project***: (2h/w) (to be continued)

The project must be in one of the environmental problem concerned with the sugar research and chemical technology.
EN5303- Technology of Sugar Industry(II): (2h/w)

1- Definition of Sugar manufacture and introduction on manufacturing steps.
2- Cane preparation.
3- Extraction of the juice by milling and diffusion.
4- Filtration of mixed juice.
5- Heating of the juice.
6- Clarification of the juice after treatment by precipitation.
7- Filtration of scums.
8- Filtration of clarified juice outside clarification tanks.
9- Concentration of juice by evaporation of water.
10- Cleaning heat surface of heaters, bodies of multiple evaporation of pan boiling.
11- Preparation of superphosphate solution.
12- Preparation of lime solution.
13- Preparation of SO$_2$.
14- Design and calculation capacity of instruments used in each mentioned step.

EN5304- Environmental Laboratory: (2h/w)

EN5305-Computer Programming: (2h/w)

1- Computer components. (computer generation - components - input and output units - control unit - microprocessor - memory decimal operational system and special letters and characters).
2- Basic Programming.
3- Fortran Programming.
4- Cobol Programming.

EN5306- Environmental Toxicology, Health and Safety: (2 h/w)

Perspectives and concerns, interrelationship and interactive approach, development projects and related aspects of safety and health, environment as the ultimate beneficiary / loser.

Safety and Health Hazards:
Identification of potential safety and health hazards in industrial and development projects, reduction strategies, policies and legislation, international and national perspective, safety standards and management systems, ISO 18000.
Industrial health safeguards and implementation mechanisms.

Health and Safety Risk Management:
Risk identification, allocation and mitigation strategies, responsibilities and authority, potential of health risks in industrial and development
processes, local and national policies, public awareness and participation in prevention procedures. Industrial environmental conditions, emissions and noise abatement.

**Toxicology**
Basic concepts, toxicity and its impacts, industrial toxicants and hazardous materials, toxic and hazardous waste management, measurement of toxicity, TLM and lethality studies, physiological and metabolic effects on flora and fauna.

**Evaluation of toxicity**
Methods used to assess toxicity classification of toxic materials. Physiological and metabolic effects of toxicants, such as VOC and organic solvents, used in industry heavy metals such as Mg, Cl, Cu, Pb, Al, AS, Zn, Mutagenic and carcinogenic compound. Anticancer drugs.

**Water and airborne Diseases**
Potential and widespread effects, water and airborne bacteria and viruses, human immune-system and its vulnerability to these bacteria and viruses, preventive and curative measures, epidemics and their containment, biological warfare and protective measures. Safeguarding water sources and ambient air quality, disaster management.

**Human Environment and Health Status in Urban and Rural India**
Water and sanitation situation in urban and rural context, historical perspective, WHO and other bodies and their role in public health projects development, eradication programs and their efficacy, development impacts in urban and rural sectors, psychological impacts, public awareness of sanitation and hygiene issues and role of NGOs.

**Current developments in the subject**

**EN5307- Standardization in Sugar Industry:** (2 h/w)
- Codex standards
- Codex standard for white sugar
- Codex standard for powdered sugar (world-wide standard)
- Codex standard for soft sugars
- Egyptian standards for brown sugar
- Codex methods of analyses
- Food standards program and codex alimentarius commission
- Acceptance of codex commodity standards
- Food additive provisions
- Explanatory notes concerning codex standards

**EN5308-Computer Systems and Performance Evaluation:** (2h/w)
1- Provides a comprehensive overview of the quantitative aspects of computer systems with a particular focus on
performance evaluation. Topics include performance measurement, the analysis and interpretation of measurement data, workload characterization and modeling, the design and evaluation of performance experiments, and the design and application of analytical techniques. A variety of application domains will be considered.

EN5309 – **Watershed Management**: (2 h/w)

**Concept of watershed management**: Definition of watershed, principle, objectives, benefits, causes of deterioration, consequences, identification of problems.

**Characteristics of watershed**: Delineation, coding, geomorphological characteristics, linear aspect, aerial aspect and relief aspect.

**Land capability classification**: objectives, role of soil characteristics, external factors, climatic factors, scheme foe classification, characteristics of land classes, land use. (Case Studies)

**Watershed resource appraisal**: watershed survey, guidelines, data requirement, institutions and cultural aspect, resources appraisal techniques, resource map, watershed problem, format for resource appraisal.

**Watershed planning**: need, level of planning, planning for land use and soil conservation, planning for watershed protection, planning for rural and integrated watershed development, plan formulation, implementation of the plan, monitoring, evaluation and follow up, constraint, management alternatives, use of format for planning for case study.

**Watershed and environment**: environmental assessment, monitoring parameters, environmental impact of watershed projects, environmental impact assessment, improvement in the environmental quality, environmental regeneration.

**Peoples participation in watershed development and management**: rational, factors, incentives, mobilization of peoples, peoples organization, participatory rural appraisal, techniques for promotion of peoples participations, role of women.

**Hydrological process in watershed**: hydrological cycles, computation, measurement and estimation of precipitation, interception, infiltration, evaporation, evapo-transpiration, surface runoff, ground water-flow.

**Soil erosion process**: types, mechanism and estimation of water erosion, wind erosion, factors affecting water and wind erosion and its estimation

**Conservation measures for aerable land**: Contour farming, strip cropping, tillage practices, mulching, vegetative ridges, biological measures, mechanical measures for water erosion control, counter bunds, graded bunds, terraces, vegetative waterways, diversion drains.
Conservation measures for non-arable lands: contour trenches, staggered, continuous gully control measures, temporary structures, reclamation of ravine land, improvement of grasslands, rehabilitation of mined lands

Role of horticulture, forestry and agro-forestry: Agro-forestry: Objectives, benefits, different systems, Regeneration, Conservation through improved practices - horticulture, forestry

Storage and control of water: Objectives, functions, traditional methods, nalaband, different techniques of water harvesting and storage of harvested water

Farming system in watershed: watershed based farming systems, crop production technology, dry land farming, livestock production, energy plants and sericulture.

Monitoring and evaluation of watershed projects: Need, target groups, selection of indicators, evaluation of self help groups, ecosystem management challenges.

Watershed development programmes: National and State policies, Funding agencies and implementation strategies.

Suggested Readings:
- Watershed Planning and Management, 2nd edition, Dr. Rajvir Singh, Yash publishing house, Bikaner, India.
- Watershed Manual by Bharat Kakade (BAIF publications)
- Recent Publications / Notes by the State Department of Agriculture, Maharashtra State.

ENV5310- Environmental Planning and Management: (2 h/w)

Environmental Planning: Historical background to know the adverse effects of lack of environmental planning. Importance and measurement of Baseline environmental data their appraisal such as Water, Soil, Air, Natural assets, Demography, Heritage, meteorology.

Important concepts and parameters for planning: a. State and national law and Act to protect the Environment, Socio-economic issues and demographic factors, b. Industrial and business growth patter, c. Natural resources and exploitation patter, d. Transportation and accessibility, e. Human resources, social behavior, economical status and aspiration for growth.
Important issues in planning a. Willingness to pay for development, b. Rehabilitation and resettlement, c. Waste generation and disposal, d. Impacts on socio-economical status, e. Change in quality of life. (Case studies)

Urban and Rural Planning: Demographic considerations, national and regional planning parameters for urban and rural areas. Development indices, industrial and business growth pattern, indigenous assets and liabilities, natural resources and exploitation patterns, accessibility and transportation development, industrial development and growth prospects, human resources, services levels and social aspirations, willingness to pay, rehabilitation and resettlement issues.

Equity, Environment and Development: Equitable development and its principles, Importance of critical review of plan with respect to local and regional levels, Immediate and long term gains and effect of development. Comparison between a. Exploitation and safe guard for conservation, b. Rate of utilization and regeneration, c. Natural and manmade growth, d. Survival need of mankind and protection of environment. Agenda 21: Role of various stakeholders in Environmental Planning and Development process

Development in the context of carrying capacity of Environment: Case study of current issue – Development plan for Urban Areas,


Rule, regulations and guidelines given for disposal of hazardous waste, municipal solid waste and bio-medical waste e.g. Hazardous Waste (Management and Handling) Act 1989.

Suggested Readings:
4. EIA – A Biography, B. D. Clark, B. D. Bissel, P. Watheam.
5. Agenda 21: Guidelines fir Stakeholders by Patwardhan&Gunale
6. Environmental Planning by A.S. Bal
7. Second world congress on engineering and environment 1985
EN5311- **Instrumental Analysis**: (2h/w)

1- Electroanalytical methods (Potentiometry – Selective ion electrodes voltammetry).
2- U.V. and visible spectrophotometric analysis.
3- Atomic absorption method of analysis.
4- Turbidity and polarimetry method.
5- IR, HNMR, CNMR and Mass Spectroscopy

EN5312- **Plant Equipment Planning**: (2h/w)


EN5401- **Quality Control in Sugar Factories**: (2h/w)

1- Definitions and expressions used in chemical control and processing control.
2- Gravimetric methods used in chemical control.
3- Apparatus used in processes of chemical control and quality control.
4- Methods used in collection of different samples.
5- Chemical reagents used in chemical analysis.
6- General analytical methods.
7- Analytical methods of different products in sugar manufacture
8- Calculation methods used in chemical analysis in sugar manufacture.

EN5402- **Research Project***: (2h/w)

EN5403- **Marketing and Market Economics** (4h/w)

EN5404- **Environmental laboratory**: (2 h/w)
EN5405- **Statistical Analysis:** (2h/w)

1- **Descriptive statistics:**
   Classifications of data - graphic presentation - central mean
   Measurement - measure of variation - examples using the computer.

2- **Linear regression and correlation:**
   Scattering graph - Linear and nonlinear curve fitting for two groups of data function in two variables - prediction - linear correlation coefficient (berson) and its relation to the linear regression coefficient - meaning of linear correlation coefficient, examples using computer.

3- **Distribution:**
   Binomial – Poisson - Normal distribution, properties and its use.

4- **Estimation and Hypotheses Testings:**
   population “sample -parameter - Point and interval estimation - confidence interval -difference between two means of normal distributions - confidence interval around of unit proportion, difference between two proportions - minimum and alternative hypothesis - significance level - mean hypothesis test has one difference between two means of normal distribution - unit mean hypothesis test and difference between two means - examples using computer.

EN5406- **Industrial Waste Management:** (2h/w)

1- Safe management of liquid industrial wastes.
2- Accurate management of hazardous wastes (chemical – biological).
3- New technologies to address the liquid industrial wastes.
4- Treatment technologies for industrial waste water.
5- Treatments for water and liquid wastes (traditional treatments for reuse and maximize their uses).
6- Integrated management interfaces of air and water pollutants.
7- Recycling bases of oils and grease as wastes.
8- Gases and boiler ash and modern methods for their investment.

EN5407- **Chromatographic Analysis:** (2h/w)

1- Introduction
2- Theory of Separation
3- Thin Layer Chromatography
4- Paper Chromatography
5- Column Chromatography
6- Gas chromatography (GC):
Types, mechanism of separation, factors influencing separation processes, Application in qualitative and quantitative analysis.
7- High Performance Liquid Chromatography (HPLC), mechanism of separation, factors influencing separation processes. application in qualitative and quantitative analysis.
8- Ion-exchange chromatography.
9- Exclusion chromatography.

EN5408- **Quality and Management:** (2h/w)
- Quality processes throughout the world.
- Management principles.
- Quality management principles.
- ISO 9000 and ISO 14000 registration.
- Quality function deployment.
- Certification and communication.

EN5409- **Process Control Engineering:** (2h/w)
Frequency response analysis; advanced control techniques; multivariable control systems; mathematical tools for computer control systems; design of computer control systems; engineering design of industrial control applications; plant wide control, concerts distributed control systems.

EN5410- **Design of Industrial Waste Treatment Systems:** (2h/w)
Designed to provide the student with the fundamentals of air and water pollution problems and the control technology and legislation associated with these problems.

EN5411- **Microbial Toxins:** (2h/w)
This course aims to provide essential knowledge in food microbes, microbial toxins, their interactions in food and their impact on public health to students with a background in microbiology. Laboratory skills relating to microbiological examination and detection of biotoxins of different food types, using traditional and latest technology to enable students to be competent professionals in a food microbiology laboratory. The course will centre on the following major themes:
- Type of microorganisms
- Microbes in air, water, soil and food
• Food microbes: diversity, sources, growth and metabolism, beneficial uses and spoilage mechanisms.
• Microbial toxins: diversity, occurrence, mechanisms of action, bioavailability, acute and chronic toxicity to humans.
• Food safety: detection methods of microbial spoilage of foods including toxins, quality control and legislative requirements for protection of public health.
• Effects of food spoilage and mechanisms of microbial toxin action, short-term and long-term toxicity to human health.

References:

EN5412- Marketing Research: (2h/w)
Examines the principles and procedures associated with the collection and analysis of relevant information in the context of solving practical marketing problems. Students have the opportunity to apply these principles at each stage of marketing research process: Problem definition, research design, data collection, data analysis, and report preparation.

EN5413- Project Economics: (2 h/w)
1- An overview, the role of projects in economic development.
2- Economic Environment.
3- Determinants of project efficiency and its indicators.
   • Kinds of efficiency – industry viz project, technical viz economic.
   • Determinants of efficiency.
   • Indicators of efficiency (Productivity & Profitability).
4- Pricing methods in theory & practice.
5- Demand analysis.
6- Project appraisal (financial and commercial studies).
7- Cases.