"Heaven's Light is Our Guide"

Institute of Energy and Environmental Studies (IEES)
Rajshahi University of Engineering & Technology (RUET)

Course Structure and Outline for Postgraduate Diploma in Energy Engineering (EE) and Environmental Engineering (Env. E)

Summary of the Courses for Postgraduate Diploma in Energy Engineering (PGD in EE)

SI. No.	Course Code	Course Title	Credit	Hours per week lecture	Hours per week Workplace / Industrial learning	Ref.
1	EE 5100	Project	6.00	-	-	-
2	EE 5101	Fundamentals of Energy Engineering	3.00	3	-	ESE, KUET
3	EE 5102	Energy Engineering and Technology	3.00	3	-	ME, RUET
4	EE 5103	Energy and Environmental Engineering	3.00	3	-	ME, RUET
5	EE 5104	Renewable Energy Technology	3.00	3	-	ME, RUET
6	EE 5105	Solar Energy	3.00	2	2 (Industrial learning)	ME, RUET
7	EE 5106	Solar Photovoltaic System	3.00	3	-	ESE, KUET
8	EE 5107	Power Plant Engineering	3.00	2	2 (Industrial learning)	ME, RUET
9	EE 5108	Energy Storage Technologies	3.00	3	-	ESE, KUET
10	EE 5109	Energy Conservation and Management	3.00	3	-	IEPT, KUET
11	EE 5110	Energy Auditing	3.00	2	2 (Workplace learning)	ME, RUET
12	EE 5111	Waste Utilization and Energy Production	3.00	2	2 (Industrial learning)	ME, RUET
13	EE 5112	Energy Efficiency Assessment	3.00	3	-	ESE, KUET
14	EE 5113	Nuclear Engineering	3.00	2	2 (Industrial learning)	ME, RUET
15	EE 5114	Energy Project Development and Evaluation	3.00	3	-	ESE, KUET
16	EE 5115	Safety and Environmental Aspects of Energy Projects	3.00	3	-	ESE, KUET

EE 5100: Project

(Credit: 6)

The students will start their project/thesis work effectively from the beginning of the semester. They will stand their research idea practically and will complete experimental set-up/ fabrication and also do some trail runs.

EE 5101: Fundamentals of Energy Engineering

(Theory: 3 Hours/Week, Credit: 3.0)

Energy Sources and potential Earth energy cycle; Sources of energy for domestic, transportation, agriculture, and industrial sectors; History of energy usages, forms of energy, present consumption; Types of resources: conventional, non-conventional, commercial, non-renewable and renewable; Current status of conventional and non-conventional sources, World and Bangladesh scenario.

EE 5102: Energy Engineering and Technology

(Theory: 3 Hours/Week, Credit: 3.0)

Energy sources: Current status of non-renewable and renewable sources, present consumption and demand scenario for Bangladesh and the world.
Non-renewable Energy: Coal: Formation, classification, and exploration; Oil: Formation, characteristics; potential, basic properties and grading;
Natural gas: Formation, Exploration; oil shale and tar sands; Nuclear resources: Types, prospects, limitations, and uses.
Solar-derived renewable energy: Solar thermal energy, Photovoltaic, Wind energy, Biomass, Hydropower, Wave energy, Ocean thermal energy Conversion. Non-solar derived renewable energy: Tidal energy, Geothermal energy, Renewable Hydrogen.

EE 5103: Energy and Environmental Engineering

(Theory: 3 Hours/Week, Credit: 3.0)

World energy resources and energy demand, Energy use in different sectors and its future trend, General survey of energy conversion systems, Level of extraction and conversion efficiency, Energy management and conservation. Environmental aspects of energy use, economics of energy utilization. Definition, history, and development of environmental science. Biotic and abiotic factors and their interactions with the environment. Human influences on the ecosystem. Scope and significance of environmental science study. Renewable and non-renewable energy, Environmental health and toxicology. Environmental problems and issues: Groundwater arsenic contamination, Stratospheric ozone layer depletion, Elnino, La-Nina, Tsunami, Acid rain, Greenhouse effect, Global warming, and climate change. Surface water pollution, Air pollution in major cities, brickfields, Industrial waste, deforestation and desertification in the Barind region etc.

EE 5104: Renewable Energy Technology

(Theory: 3 Hours/Week, Credit: 3.0)

Prospects of renewable energy, Characteristics of renewable energy sources and their differences compared to fossil fuels. Technological basis for harnessing renewable energy sources.
Solar energy: Generation, solar radiation; Solar thermal conversion: solar heating, cooling and desalination;
Solar photovoltaic: basic operation, semi-conductor devices, electrical characteristics, and generation of electrical energy;
Biomass energy: Concept of biomass and biofuels, characteristics;
Biochemical conversion: biogas production with its operating parameters; types of digesters; Ethanol production; Thermo-chemical conversion: preparation of feedstock, incineration, pyrolysis, gasification, carbonization, densification, briquetting; Modern use of biomass: processing for oils and fats, bio-diesel, gasohol;
Wind Energy: Basics of wind generation, wind measurement, wind turbines; aerodynamic behavior of turbine blades, power coefficient, thrust coefficient, overall efficiency, overall power output.
Hydropower: basic concepts; geothermal energy, OTEC. Energy efficiency: Efficiency of conversion systems in current use, matching of energy sources to the application of hybrid and stored energy systems, waste heat rejection, and utilization. Environmental impact: Aspects of air and water pollution, and waste disposal problems arising from conversion systems.
Main components of different renewable energy systems, Comparisons of different renewable energy technologies and selection of the most appropriate based on local conditions.

EE 5105: Solar Energy

(Theory:2 Hours/Week, Industrial learning: 2 Hours/Week, Credit:3.0)

Sun earth relationships, solar radiation, and its measurement, solar radiation climatology; thermal processes in solar and flat-plate collectors; concentrating collectors; applications of solar thermal energy; photoelectric effect in semiconductor p-n junctions, solar photovoltaic components and systems, design of photovoltaic systems for electrification and water pumping; applications of photovoltaic solar energy; storage systems for solar energy; recent advances in solar energy applications.

Industrial learning relevant to course contents.

EE 5106: Solar Photovoltaic System

(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Introduction: PV physics, band structure and Fermi level in semiconductors, pn-junctions, diode models, photon interactions with semiconductors.
PV Cell Fundamentals: Working principle, Computing PV cell power, equivalent circuit models, short- and open-circuit properties, fill factor, and parasitic resistances. PV cell external and internal quantum efficiency, and computing the spectral response. Theoretical cell efficiency, multi-junction devices, the Shockley-Queisser limit. Antireflection coatings, cell passivation, and cell optical properties.

PV Technology: PV cell architecture and fabrication steps, characterization techniques crystalline Si substrates, thin film deposition, amorphous Si, CIGS, and CdTe thin-film cells.
PV Systems: Introduction to PV systems, Location and orientation issues, factors affecting performance, PV cells wired in series and parallel, shaded and faulty cell effects, Components of PV systems, system integration- online and offline, inverters, design criteria, calculation, economics and ecology of PV system, load analysis, life cycle analysis, and cost estimation.

EE 5107: Power Plant Engineering

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit:3.0)

Introduction: Types of power plants and their modern trend, Field survey of power plants in Bangladesh, gas plant.
Diesel Electric Power Plant: Scope, Arrangements, Air fuel system, Cooling system and lubrication system, Starting methods.
Steam Power Plant: Introduction, Principle of operation, Steam turbine and its performance, Stage efficiency, Installation of steam power plant, Fuel handling and burning system.
Hydroelectric Power Plant: Types of operation, Site selection, Turbine selection, Seasonal and intermittent plants, Components of the plant, Efficiency.
Gas Turbine Power Plant: Scope, Installation, Governing, and Maintenance.
Nuclear Power Plant: Scope, Plant layout, Types of reactors, Fuels, Waste disposal and safety.
Hybrid Power Plant: Concept, Solar/wind hybrid system, Diesel/wind hybrid system, Solar/biomass hybrid system.

Industrial learning relevant to course contents.

EE 5108: Energy Storage Technologies

(Theory: 3 Hours/Week, Credit: 3.0)

Introduction to Energy Storage for Power Systems: Role of energy storage systems, Applications. Overview of Energy Storage Technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical, and Efficiency of energy storage systems.
Electrical Energy Storage: Batteries, Supercapacitors, Superconducting Magnetic Energy Storage (SMES), Charging methodologies, SoC, and SoH estimation techniques. Hydrogen production and storage, fuel cells.
Hybrid Energy Storage Systems: Configurations and applications.
Storage for Renewable Energy Systems: Solar energy, Wind energy, pumped hydro energy, Fuel cells. Energy storage in Micro-grid and Smart grid. Energy Management with storage systems, Battery SCADA, increases of energy conversion efficiencies by introducing energy storage.

EE 5109: Energy Conservation and Management

(Theory: 3 Hours/Week, Credit: 3.0)

Introduction: Approach and benefits of energy conservation, principles of energy conservation, Energy conservation organization, and phases; Various energy conservation opportunities.
Steam generators and condensate systems: Losses in boiler and efficiency improvements; Boiler controls: proportional, differential, and integral control; Blow-down and control; Steam traps, their types, and maintenance; Energy conservation in pumps, fans, blowers, and air compressors; Energy consumption and saving potentials;

Energy Efficient Building: Estimation of energy, Steady and unsteady heat transfer through glazed window and wall, Standards for thermal performance of building envelope, Evaluation of overall thermal transfer; Design consideration for energy conservation, Energy conservation acts and its features.
Energy Management: Energy scenario in Bangladesh; Energy monitoring, auditing and targeting; Economics of various energy conservation schemes, Total energy systems, Introduction to energy auditing, review and applications, Case studies; Energy management motivation, Role of energy managers in industries; Energy pricing, Energy security. cf.

EE 5110: Energy Auditing

(Theory:2 Hours/Week, Workplace learning: 2 Hours/Week, Credit:3.0)

Notions of energy conservation and efficiency, analysis of systems employed to provide energy services, integrated approach to energy auditing, assessing the elements of system optimization, examples of typical applications (steam generation and distribution, process or comfort cooling, pumping and compressed air).

Workplace learning relevant to course contents.

EE 5111: Waste Utilization and Energy Production

(Theory:2 Hours/Week, Industrial learning: 2 Hours/Week, Credit:3.0)

Sources of waste generation; Nature and composition of available wastes, Traditional uses of wastes, and their prospects for energy recovery. Current technology for energy production: Physical process: Briquetting Thermochemical process: Incineration, Pyrolysis, and Gasification; Biological Process: production of bio-diesel, bio-ethanol, and biogas. Social, economic and environmental factors for waste to energy conversion; Cost analysis, Case studies.

Industrial learning relevant to course contents.

EE 5112: Energy Efficiency Assessment

(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Fundamentals: Tariff and economic considerations, Transmission and distribution losses, Mechanical losses in power production, Electrical load, and demand management, Role of power factor and improvement, Electrical power systems analysis.
Energy assessment in mechanical systems: Types of pumps and turbines and their classification, Performance, and characteristics of turbines, Pumps and compressors, Types of IC engines and performance analysis. Different thermodynamic cycle and efficiency analysis.
Energy assessment in electrical systems*:* Motors- Fundamentals and types, characteristics, efficiency, factors affecting energy efficiency, soft starters, variable speed drives. Generators- Fundamentals, types, capacity selections, performance assessment; energy conservation opportunities; Transformer systems- Fundamentals; types, capacity selections, performance assessment; energy conservation opportunities.

EE 5113: Nuclear Engineering

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit:3.0)

Radioactivity: Alpha, Beta, and Gamma rays, Radioactive Decay, Units of radioactivity, Interaction of gamma rays, Neutrons, and charged particles with matter, The basis of the theory of radioactive disintegration, The disintegration constant, Radioactive decay, Half-life and Mean Life. Nuclear Reaction: Possible types of nuclear interactions, Nuclear fission, and fusion.
Nuclear Power Development: Difference between PWR and BWR, Safety features of VVER (Russian PWR, which the Bangladesh Govt. is going to establish at Ruppur site), Fast breeder reactor, Bangladesh.
Nuclear Power Generation: Basics of nuclear power generation, Design, analysis, and fabrication of nuclear power systems, Energy conversion in nuclear power systems, Corrosion in nuclear power systems: structural metals in nuclear power plants, operation, and maintenance of nuclear power plant, Reactor Controls, Rector Coolants, and Radioactive waste disposal.
Nuclear Fuel Cycle and Waste Management: Components of Nuclear Fuel Cycle (NFC), types of NFC, components of the NFC with diagram, differences between closed and open NFCs, classification of radioactive wastes, types of wastes associated with PWR operations.
Water Management of Nuclear Power Plant: Different types of cooling systems, once through, Wet cooling tower, Dry cooling tower, etc.

Industrial learning relevant to course contents.

EE 5114: Energy Project Development and Evaluation

(Theory: 3 Hours/Week, Credit: 3.0)

Energy Project Preparation and Development: Features of energy projects, project cycle, the context of energy projects, project identification, project proposal preparation, pre-feasibility and feasibility studies, budgeting, project approval, and implementation.
Cost Concepts and Financial Calculations: Cost concepts, time value of money, interest formulas and equivalence, inflation, methods of project evaluation, and deprecation.
Evaluation of Energy Projects: Alternatives methods of project evaluation, Traditional methods, and new developments, valuation of costs and benefits, Uncertainty and risk analysis of projects, Sensitivity and break-even analysis.
Financial Evaluation of Projects: Sources of funds, project financing, elements of financial costs, financial structure and project feasibility, revenue streams, effects of assumptions and pricing, and sensitivity analysis.
Environmental Issues in Energy Projects: Evaluation of environmental impacts, methods of economic evaluation of environmental impacts, energy sector and environmental policies, case studies.
Economic Evaluation of Energy Projects: Alternatives methods of project evaluation, Traditional methods, and new developments, valuation of costs and benefits, Uncertainty and risk analysis of projects, Sensitivity and break-even analysis.
Financial Evaluation of Projects: Sources of funds, project financing, elements of financial costs, financial structure and project feasibility, revenue streams, effects of assumptions and pricing, and sensitivity analysis.
Environmental Issues in Energy Projects: Evaluation of environmental impacts, methods of economic evaluation of environmental impacts, energy sector and environmental policies, case studies.

EE 5115: Safety and Environmental Aspects of Energy Projects

(Theory: 3 Hours/Week, Credit: 3.0)

Safety Management: Basic about the hazard, risk, accident, safety, and safety management; sustainable development and triple bottom line theory; evolution of hazards, hazards classification and detail of different types of hazards, safety audit, accident investigation, and reporting; characteristics of petroleum fuels, explosive mixture, and their limits; fire, explosion, and BLEVE incidences and their management; electrical hazard management; uses of personnel protective equipment's, practice for following different work permits; duties and responsibilities of safety officer/engineer and safety committee; hazard or safety ratings of industries-Accident Frequency Rate (AFR), Accident Severity Rate (ASR) and Fatal Accident Rate (FAR).

Environmental Issues and Pollution control**:** Pollution and their types; environmental impact by thermal power plants and petroleum industries; the concept of a greenhouse, acid rain, sustainable development; environmental regulations, the concept of Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Environmental Management Plan (EMP) and ISO-14001 - 14002, industrial categories based on Bangladesh environmental regulation (DOE).

Summary of the Courses for
Postgraduate Diploma in Environmental Engineering (PGD in Env. E)

SI. No.	Course Code	Course Title	Credit	Hours per week lecture	Hours per week Workplace / Industrial learning	Ref.
1	ENVE 5200	Project	6.00		-	-
2	ENVE 5201	Introduction to Environmental Engineering	3.00	3	-	RU
3	ENVE 5202	Energy and Environmental Engineering	3.00	3	-	ME, RUET
4	ENVE 5203	Environment, Development, and Society	3.00	3	-	RU
5	ENVE 5204	Environmental Pollution	3.00	2	2 (Industrial learning)	RU
6	ENVE 5205	Hazardous Waste Management	3.00	2	2 (Industrial learning)	RU
7	ENVE 5206	Environmental Health and Sanitation	3.00	2	2 (Industrial learning)	CE, RUET
8	ENVE 5207	Waste Water Engineering	3.00	2	2 (Industrial learning)	CE, RUET
9	ENVE 5208	Environmental Development Project	3.00	3	-	CE, RUET
10	ENVE 5209	Carbon Capture and Storage System	3.00	2	2 (Industrial learning)	IIDT
11	ENVE 5210	Energy Efficient Building	3.00	2	2 (Industrial learning)	IEPT, KUET
12	ENVE 5211	Aerosol Technology	3.00	2	2 (Industrial learning)	ME, RUET
13	ENVE 5212	Environmental and Economic Impact Assessment	3.00	3	-	IEPT, KUET
14	ENVE 5213	Automotive Air Pollution Control	3.00	3	-	ME, RUET

ENVE 5200: Project

(Credit:6)

The students will start their project/thesis work effectively from the beginning of the program/ semester. They will stand their research idea practically and will complete experimental set-up/ fabrication and also do some trail runs.

ENVE 5201: Introduction to Environmental Engineering

(Theory: 3 Hours/Week, Credit: 3.0)

Introduction to Environmental Engineering: Ecology and environment; climate change; Biodiversity. Environmental problems and issues: Groundwater arsenic contamination, Tsunami, Acid rain, Greenhouse effect, Global warming and climate change. Surface water pollution, Air pollution in major cities, Industrial waste, deforestation and desertification in the Barind region, Hill cutting and shifting cultivation, Top-dying symptoms of Sundarban, Agrochemical pollution, Bhopal gas leak, etc. Renewable and non-renewable energy, Environmental health and toxicology. Concepts of sustainable development. Environmental laws and ethics, Environmental awareness and global environmental politics.

ENVE 5202: Energy and Environmental Engineering

(Theory: 3 Hours/Week, Credit: 3.0)

World energy resources and energy demand, Energy use in different sectors and its future trend, General survey of energy conversion systems, Level of extraction and efficiency of conversion, Energy management and conservation. Environmental aspects of energy use, economics of energy utilization. Definition, history, and development of environmental science. Biotic and abiotic factors and their interactions with the environment. Human influences on the ecosystem. Scope and significance of environmental science study. Renewable and non-renewable energy, Environmental health and toxicology. Environmental problems and issues: Groundwater arsenic contamination, Stratospheric ozone layer depletion, Elnino, La-Nina, Tsunami, Acid rain, Greenhouse effect, Global warming, and climate change. Surface water pollution, Air pollution in major cities, brickfields, Industrial waste, deforestation and desertification in the Barind region etc.

ENVE 5203: Environment, Development and Society

(Theory: 3 Hours/Week, Credit: 3.0)

The connection between environment, development, and society, Industrialization and risk society, Challenge of sustainable development, Perception of the environment, Dependence for livelihood, Identity, and Power of natural resources, Social ecology, Role of religion in determining our world view and relation with the environment, Development projects and recent conflict over natural resources, Understanding major environmental disasters and industrial accidents, Global climate change negotiations, gender, and environment.

ENVE 5204: Environment Pollution

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit: 3.0)

Water Pollution: Definition, Classification of water pollutants, Sources and consequences of water pollution and Wastewater treatment techniques.
Air Pollution: Definition, Sources, and types of air pollutants, Effects and control of air pollution.

Noise Pollution: Definition, Sources, Effects and Control of noise pollution.
Radiation Pollution: Definition, Radiation sources in the environment, biological effects of radiation, dose limits, Control for radioactive sources, and Radiation apparatus.
Soil Pollution: Definition, Causes of soil pollution, Effects and control of soil poll Solid Waste: Sources and types of solid waste, Physical and chemical properties of solid waste, Domestic waste, domestic solid waste, Disposal of municipal and Industrial waste-different methods: Sludge treatment and disposal facilities, Recovery of resources.

Industrial learning relevant to course contents.

ENVE 5205: Hazardous Waste Management

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit: 3.0)

Hazardous waste: Identification and characteristics of hazardous waste, Processing and treatment of hazardous physical processes, Chemical processes, Thermal processes, biological processes, natural systems for hazardous waste treatment, Waste stabilization pond, Aquatic weeds, and constructed wetland system, Hazardous waste disposal, biological detoxification and Application of biotechnology.

Industrial learning relevant to course contents.

ENVE 5206: Environmental Health and Sanitation

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit: 3.0)

Environmental Health: World population, fundamentals of environmental health, chronic and communicable diseases, water supplies, environmental health in recreational areas, wastewater management, solids, and hazardous waste management, toxicology, radiological health, shelter environments, environmental safety, air quality, food protection and safety, occupational health, principles of environmental health administration;
Environmental Sanitation: Introduction to environmental sanitation, environmental pollution, environmental protection, and management, differ rent sanitation options, various types of latrines, low-cost sanitation technology, construction and maintenance of sanitation facilities, community latrine cum bio-gas plant, sustainability of sanitation services, building sanitation, code of practice.

Industrial learning relevant to course contents.

ENVE 5207: Waste Water Engineering

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit: 3.0)

Wastewater Engineering: introduction; estimation of wastewater; wastewater collection systems; hydraulics of sewer; design, construction, and maintenance of sanitary sewer and storm drainage system; sewer appurtenances; plumbing system, design of septic tank and soak well, small bore sewerage system.
Wastewater quality and treatment: Microbiology of wastewater; wastewater characteristics; wastewater treatment (preparatory, primary, and secondary treatment) and disposal; treatment and disposal of industrial effluents; sludge treatment and disposal; waste stabilization ponds.
Health and Hygiene: Disease description, transmission, and control, integrated approach for water, sanitation and health education, environmental management, and environmental impact assessment.

Industrial learning relevant to course contents.

ENVE 5208: Environmental Development Project

(Theory: 3 Hours/Week, Credit: 3.0)

Environment and sustainable development, environmental policies and legislation, environmental implication of sectoral development, environmental quality standards, environmental issues and priorities, environmental impact assessment of development schemes, baseline studies, assessment methodologies, and economics of environmental management.

ENVE 5209: Carbon Capture and Storage

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit: 3.0)

Introduction to the source of CO_2 (Greenhouse gas) from thermal energy systems and their Global warming potential (GWP), Carbon and CO_2 cycle, Scenario of CO_2 concentration in the atmosphere, Relationship between radiative forcing and greenhouse gas concentration, Estimation of the equilibrium surface temper change, and global warming and climate change. Mechanism of CO_2 emission formation during combustion in power plants (steam turbine, gas turbine, and internal combustion engines), CO_2 emission reduction by use of alternative fuels and energy efficiency improvement in the thermal energy system, Measurement and analysis of CO_2 emission in heat engines/power plants / thermal energy system. Carbon capture: different methods (physical/chemical/biological) of Carbon capture from power plants, CO_2 capture through pre-combustion methods, oxygen-combustion method, post-combustion methods (physical solvents/sorbents, membranes, cryogenic fractionation), Chemical-looping combustion and algae species. Carbon storage under empty oil wells, Ocean storage, etc. Carbon sequestration: mineral carbonation, Photosynthesis of plants, Fuel production, Refrigerant, Dry ice, Fertilizer, Working fluid for power plants, Industrial applications (textile, paint, mining, oil, etc.), and Case studies / numerical calculations for energy input requirement for CCS system.

Industrial learning relevant to course contents.

ENVE 5210: Energy Efficient Building

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week, Credit: 3.0)

Introduction: Concepts of energy-efficient building, Energy flow in building, Climate and its influence on energy requirement, Heating, and cooling of the building, Concept of low energy, Zero energy, and green building.
Indoor Environment of Building: Components of the indoor environment, Quality of indoor environment, Human comfort, elements of human comfort, Heat gain through the building envelope, Visual acoustic and olfactory comfort, Infiltration and ventilation, and their significance, Daylighting, and electric lighting.
Energy Management in Buildings: Energy use in building, Techniques for reducing energy consumption in building.
Energy efficient System in Building: Energy efficient lighting system, Smart windows, Building integrated photovoltaic system, Energy efficient HVAC system.

Industrial learning relevant to course contents.

ENVE 5211: Aerosol Technology

(Theory: 2 Hours/Week, Industrial learning: 2 Hours/Week)

Aerosol physics, Aerosol chemistry, Sources and sinks of aerosols in indoor and outdoor environments, Lung deposition, Particle size distribution, Sampling and measurement techniques. Aerosol properties and typical particle pollution in indoor and working environments as well as in ambient air. Particles' effects on human health and environment. Application of aerosol technology in clean room technology, Electronics, and pharmaceutical industry.

Industrial learning relevant to course contents.

ENVE 5212: Environmental and Economic Impact Assessment

(Theory: 3 Hours/Week, Credit: 3.0)

Environmental Impact, assessment (EIA): Introduction to ETA, types, environmental concerns and indicators; EIA principle, key methods; Consultation and public participation in EIA;
EIA projects: Coal, oil, natural gas-based, Nuclear, Hydro, Wind, Solar, (isothermal; Scope and alternatives; EIA on land and biological environment; Baseline data and environmental setting; Environmental impact statement (EIS); Environmental due diligence (EL - Impact prediction methodology and mitigation measure; Environmental safety public health; Climate adaptation planning; Strategic environmental appraisal; National and International laws related 'to EIA and practices in Bangladesh; Bangladesh IF, Environmental Conservation Act (ECA, 1995), Bangladesh Environmental Conservation Rules (ECR, 1997).
Economic Assessment: Economics measurement of environmental impacts; Theoretical basis and practical applications; Selectively applicable techniques of valuing environmental impacts; Potentially applicable techniques of environmental impacts; Maximum credible accident; Rapid environmental impact assessment and limits of economic measurement; Environmental management plan (EMP), Case studies.

ENVE 5213: Automotive Air Pollution Control

(Theory: 3 Hours/Week, Credit: 3.0)

Pollutants from diesel and gasoline engine: causes of formation of UHC, SO_X, NOx, CO, PM, and odor from diesel and gasoline engine, comparison of diesel and gasoline emissions. Methods of controlling diesel and gasoline engine emissions. Effects of different engine parameters on emission and their optimization. Fuel modification: Alternative fuel and additive for diesel and gasoline engines. Exhaust after treatment: Particulate trap, Three-way catalyst, oxidation catalyst, EGR, reduction catalyst, thermal reactor. Emission of modern engines: Hybrid vehicles, electric vehicles, fuel cell vehicles, solar energy for vehicle propulsion. Effects of air pollutants on human health and on materials.

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