

SWAMI VIVEKANAND SUBHARTI UNIVERSITY,
MEERUT



FACULTY OF ENGINEERING & TECHNOLOGY

ORDINANCE No. V-42 (B9)

**RELATING TO COURSE CURRICULUM & SYLLABUS
OF PG PROGRAM**

MASTER OF TECHNOLOGY (M.Tech.) EEM

(Effective from the Session – 2025-26)

Approved by the Academic Council of the Meeting held on 06 May 2025

Approved by the Executive Council of the Meeting held on 28 June 2025

(A. Mukesh Rohela)



(A. Kapil)

(A. Suresh Bhardwaj)

(Mayank Keshwar Singh)



Subharti Institute of Technology and Engineering

Swami Vivekanand Subharti University, Meerut

(Approved by AICTE)

Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)

Ph.: 0121-2439157, Ext. 2222, 2221, Fax: 0121-2439108

E-mail: principal.site@gmail.com, principal.engg@gmail.com, Website: www.subharti.org



M.Tech
(Environmental Engineering & Management)

I Year/I Semester

w.e.f academic Session 2025-26

SEMESTER I: Foundation and Advanced Core Concepts														
S. No.	Course Code	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	EECC -101	ENERGY ENVIRONMENT AND CLIMATE CHANGE	CC	3	1	0	20	10	30	-	70	-	100	4
2	EECC -102	ADVANCED WATER AND WASTEWATER TREATMENT TECHNIQUES	CC	3	1	0	20	10	30	-	70	-	100	4
3	EECC -103	WATER SUPPLY SYSTEMS	CC	3	1	0	20	10	30	-	70	-	100	4
4	EEDE -115	ENVIRONMENT POLLUTION AND SUSTAINABLE DEVELOPMENT	DEC-1	3	0	0	20	10	30	-	70	-	100	3
5	EEDE -116	INDUSTRIAL WASTE MANAGEMENT	DEC-2	3	0	0	20	10	30	-	70	-	100	3
6	EEHM -114	VALUE EDUCATION	CHM	3	0	0	20	10	30	-	70	-	100	3
7	EEPC -151	WATER SAMPLING & TESTING LAB	PC	0	0	4	-	-	-	15	-	35	50	2
TOTAL													650	23

M.Tech
(Environmental Engineering & Management)

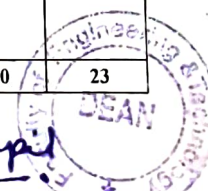
I Year/II Semester

w.e.f academic Session 2025-26

w.e.f academic Session 2025-26

SEMESTER I: Foundation and Advanced Core Concepts														
S. No.	CourseCode	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	EECC -201	AIR POLLUTION CONTROL	CC	3	1	0	20	10	30	-	70	-	100	4
2	EECC -202	NATURAL RESOURCES AND BIODIVERSITY	CC	3	1	0	20	10	30	-	70	-	100	4
3	EECC -203	ENVIRONMENTAL POLICY & IMPACT ASSESSMENT	CC	3	1	0	20	10	30	-	70	-	100	4
4	EEDE -215	SOLID & HAZARDOUS WASTE MANAGEMENT	DEC-3	3	0	0	20	10	30	-	70	-	100	3
5	EEDE -216	INSTRUMENTATION (Spectrometry & Chromatography)	DEC-4	3	0	0	20	10	30	-	70	-	100	3
6	EEOE -227	RESEARCH METHODOLOGY AND IPR (RM)	OEC-2	3	0	0	20	10	30	-	70	-	100	3
7	EEPC -251	AIR SAMPLING & TESTING LAB	PC	0	0	4	-	-	-	15	-	35	50	2
TOTAL													650	23

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M.Tech (Environmental Engineering & Management)

IInd Year/III Semester

w.e.f academic Session 2025-26

SEMESTER III														
S. No	Course Code	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	EEPC -353	Seminar-I/Project	Project	0	0	12	-	-	-	100	-	200	300	12
2	EEIT -354	Industry Internship / Live Case Study (Optional, Online/Offline)	Field Work	-	-	-	-	-	-	50	-	-	50	2
TOTAL													350	14

M.Tech

(Environmental Engineering & Management)

M.Tech II Year/IV Semester

w.e.f academic Session 2025-26

SEMESTER IV														
S. No	Course Code	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	EEDE -454	Dissertation Phase II (Project Execution & Thesis)	Project	0	0	20	-	-	-	200	-	300	500	20
TOTAL													500	20

- Core Courses (CC);
- Discipline Elective Courses (DEC);
- Open Elective Courses (OEC);
- Seminar; Constitutional, Human and Moral Values (CHM);

M.TECH. (PE) TOTAL CREDITS – 80

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M.TECH (Environmental Engineering and Management)
W.E.F ACADEMIC SESSION 2025-26
LIST OF ELECTIVE, OPEN ELECTIVE AND AUDIT COURSES

CORE COURSE (CC)

1. ENERGY ENVIRONMENT & CLIMATE CHANGE (EECC-101)
2. ADVANCED WATER AND WASTEWATER TREATMENT TECHNIQUES (EECC-102)
3. WATER SUPPLY SYSTEMS (EECC-103)
4. WATER SAMPLING & TESTING LAB (EEPC-151)
5. AIR POLLUTION CONTROL (EECC-201)
6. NATURAL RESOURCES AND BIODIVERSITY (EECC-202)
7. ENVIRONMENTAL POLICY & IMPACT ASSESSMENT (EECC-203)
8. AIR SAMPLING & TESTING LAB (EEPC-251)
9. INDUSTRY INTERNSHIP / LIVE CASE STUDY (OPTIONAL, ONLINE/OFFLINE) (EEIT-354)
10. MINOR PROJECT (EECC-353)
11. PHASE-II DISSERTATION (EECC-451)

LIST DISCIPLINE ELECTIVE COURSE:

DISCIPLINE ELECTIVE COURSE-1 (DEC)

1. UNIT OPERATIONS & PROCESSES (EEDE-111)
2. WATER & WASTE WATER TREATMENT (EEDE -112)
3. WASTE TREATMENT SYSTEMS (EEDE-113)
4. ENVIRONMENTAL MANAGEMENT (EEDE -214)
5. ENVIRONMENT POLLUTION AND SUSTAINABLE DEVELOPMENT (EEDE-115)

Manoj Kapil



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6.

DISCIPLINE ELECTIVE COURSE-2 (DEC)

1. INDUSTRIAL WASTE MANAGEMENT (EEDE-116)
2. ENVIRONMENTAL POLICY (EEDE-117)
3. BIOMEDICAL ENGINEERING (EEDE-118)
4. WATER & SEWAGE TREATMENT (EEDE -219)

DISCIPLINE ELECTIVE COURSE -3 (DEC)

1. ENVIRONMENTAL BIOTECHNOLOGY (EEDE -211)
2. ENERGY AND CLIMATE CHANGE (EEDE -212)
3. ENVIRONMENTAL REMOTE SENSING AND GIS (EEDE -213)
4. WATER RESOURCES MANAGEMENT (EEDE -214)
5. SOLID & HAZARDOUS WASTE MANAGEMENT (EEDE-215)

DISCIPLINE ELECTIVE COURSE-4 (DEC)

1. INSTRUMENTATION (Spectrometry & Chromatography) (EEDE-216)
2. INDUSTRIAL EMISSION CONTROL SYSTEM (EEDE -217)
3. ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY (EEDE -218)
4. ENVIRONMENT SANITATION HEALTH & HYGIENE (EEDE -119)
5. WATER RESOURCES MANAGEMENT (EEDE 220)



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DISCIPLINE ELECTIVE COURSE-2 (DEC)

1. INDUSTRIAL WASTE MANAGEMENT (EEDE-116)
2. ENVIRONMENTAL POLICY (EEDE-117)
3. BIOMEDICAL ENGINEERING (EEDE-118)
4. WATER & SEWAGE TREATMENT (EEDE -219)

DISCIPLINE ELECTIVE COURSE -3 (DEC)

1. ENVIRONMENTAL BIOTECHNOLOGY (EEDE -211)
2. ENERGY AND CLIMATE CHANGE (EEDE -212)
3. ENVIRONMENTAL REMOTE SENSING AND GIS (EEDE -213)
4. WATER RESOURCES MANAGEMENT (EEDE -214)
5. SOLID & HAZARDOUS WASTE MANAGEMENT (EEDE-215)

DISCIPLINE ELECTIVE COURSE-4 (DEC)

1. INSTRUMENTATION (Spectrometry & Chromatography) (EEDE-216)
2. INDUSTRIAL EMISSION CONTROL SYSTEM (EEDE -217)
3. ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY (EEDE -218)
4. ENVIRONMENT SANITATION HEALTH & HYGIENE (EEDE -119)
5. WATER RESOURCES MANAGEMENT (EEDE 220)





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OPEN ELECTIVE COURSES (OEC)

1. QUALITY SYSTEM MANAGEMENT(EEOE-001)
2. DISASTER MANAGEMENT (EEOE-002)
3. ENERGY AND GREEN TECHNOLOGIES (EEOE-003)
4. INDUSTRIAL SAFETY(EEOE-004)
5. CLIMATE CHANGE AND CURRENT ISSUES(EEOE-005)
6. ENVIRONMENTAL AUDITING (EEOE-006)
7. ARTIFICIAL INTELLIGENCE (EEOE-007)
8. RESEARCH METHODOLOGY AND IPR (EEOE-227)

SEMINAR; CONSTITUTIONAL, HUMAN AND MORAL VALUES (CHM)

1. ENGLISH FOR RESEARCH PAPER WRITING (EEHM-111)
2. SANSKRIT FOR TECHNICAL KNOWLEDGE (EEHM-113)
3. VALUE EDUCATION (EEHM-114)
4. CONSTITUTION OF INDIA (EEHM-115)
5. PEDAGOGY STUDIES (EEHM-116)
6. STRESS MANAGEMENT BY YOGA (EEHM-117)
7. PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILL (EEHM-118)
8. INDUSTRY INTERNSHIP / LIVE CASE STUDY (OPTIONAL, ONLINE/OFFLINE) (EEIT-354)



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Swami Vivekanand Subharti University, Meerut

Subharti Institute of Technology and Engineering

Department of Environmental Engineering

**Syllabus
of**

**M.Tech Environmental Engineering and
Management (EEM)**





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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

SUB: Energy Environment & Climate Change

Code :EECC-101

Objective: To cover the technological and scientific aspects of energy and environment questions including energy conservation, Papers covering energy related aspects of wider environmental questions are included.

- Unit 1:** Environment and its component, biosphere, Energy sources and their impact on environment, Laws of energy, Future energy option and challenges. **Wind Energy:** Origin of wind, quantification of wind energy in India, wind energy conversion systems, introduction to wind mill and wind electric generators.
Hydro-Power: Introduction, hydro-power generation, hydro-power potential in India, Micro, Mini & Mega-power projects potential & prospects.
- Unit 2:** **Geothermal Energy:** Introduction and nature of geothermal fields, geothermal energy, Physics of geothermal resources, Technology for exploiting geothermal resources, Potential and prospects in India. Characteristics of solar radiation, solar radiation measurement, solar energy conservation techniques: Solar collectors Photo-Voltaics: Principle of solar cell, Physics of semiconductor junction, Hierarchy of PV system, development of amorphous silicon solar cells technology, application of solar photovoltaic for lighting and water pumping
- Unit 3:** **Bio-Energy:** Biomass potential and production in India, biomass conversion processes. Introduction of biogas plant, biomass gasifies and smokeless chullah Energy from fossil fuels: Sources, properties, production & processing.
Tidal Energy: Introduction and principle of tidal power generation, potential and prospects of tidal energy in India. **Major alternative fuels**
- Unit 4:** Global climate change: Greenhouse effect, greenhouse gases: sources, trends, radiative forcing, warming potential of gases. Photosynthetic mechanism and global climate change, Impacts of global warming: Polar ice caps and melting of glaciers, sea level increase, weather extreme. Tools to study climate change: Mitigation strategies for global warming: biological carbon sequestration, carbon sequestration in geological formations, role of forests and drylands in carbon sequestration, carbon capture and storage technologies, Kyoto protocol, CDM and carbon trading.
- Unit 5:** CO₂ challenge, Energy efficiency, Fossil fuels and CO₂ emission reduction, Global warming as an energy problem. Impact of climate change on energy demand, Sensitivity of energy demand to temperature changes, Climate protection and energy changes. Ecosystems, human health, coral leaf bleaching, surface ocean chemistry, biogenic calcification in oceans, Climate change modeling and general circulation models. Energy and carbon emissions, World energy use and current energy scenario, Trends in energy use of oil, coal and gas, Energy use and air quality, Nuclear energy and environment, Energy production, Fission and fusion, Geoengineering

Outcomes:

After this course, students will be able to:

- Developments of knowledge in the specific field of practice
- Working effectively and confidence improvement
- Use the proper decision tools to critically, analytically, and creatively solve problems and drive results
- Apply environment & ecology knowledge to real-world problems
- Design eco-safe and economically viable solutions
- Identify and evaluate environmental stability and risk issues
- Analyze and articulate recent environmental challenges





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Reference Books:

1. Renewable energy by Godfrey Boyle
2. Renewable energy by N.K.Bansal
3. Non-Conventional energy system by K.M.Mittal
4. Renewable energy Sources and their environmental impact by S.A.Abbasi & Nassema Abbasi
5. Non-Conventional energy by Ashok K Desai
6. Energy by Hinrices R.A. & Kleinbach, M
7. Energy by Jeffrey Gordon
8. Green Energy by Ajit Verma & Basant Behera
9. Environmental Engineering By: Gerard Kiely Publisher: McGraw-Hill
10. Environmental Chemistry By: A.K. De Publisher: New Age International

M.Tech (EEE)





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Subharti Institute of Technology and Engineering
Department of Environmental Engineering

M.Tech (Environmental Engineering & Management)

Subject: ADVANCED WATER AND WASTEWATER TREATMENT TECHNIQUES

Code: EECC-102

Objective: To provide the detailed knowledge about various steps (Primary, Secondary and Tertiary treatment) include in wastewater treatment also different processes for sludge treatment

- Unit 1:** Gas transfer, Aeration system, Energy requirement, Design of aeration systems, Membrane filtration: Terminology, Process classification, membrane configurations, membrane operations for micro filtration, Ultra filtration and reverse osmosis, Area requirement, membrane fouling and its control, Application of membranes, Electro-dialysis: Theory, area and power requirement, Disposal of concentrate waste streams.
- Unit 2:** Grit removal: Types of grit chambers, Characteristics, quantities, processes and disposal of grit, Design of grit chambers, Floatation: Objective, Types of floatation systems, Design considerations, Chemical precipitation for removal of phosphorus, heavy metals and dissolved inorganic substances.
- Unit 3:** Microbial growth kinetics, Modeling suspended and attached growth treatment processes, Suspended growth processes for biological nitrification and de-nitrification, Biological nitrogen and phosphorus removal.
- Unit 4:** Anaerobic sludge blanket processes: Design considerations for Up Flow Anaerobic Sludge Blanket process: Theory and design of sludge treatment, Sludge thickening, Sludge drying, Incineration, Aerobic and Anaerobic digestion of sludge.
- Unit 5:** Wet-lands and aquatic treatment systems; Types and applications, Treatment kinetics and effluent variability in constructed wet-lands and aquatic systems, Free water surface and subsurface constructed wMETL-lands, Floating plants (water hyacinths and duckweed), Combination systems, Design procedures for constructed wMETL-lands, Management of constructed wet-lands and aquatic systems.

Outcomes:

Developments of knowledge in the specific field of practice

Working effectively and confidence improvement

Use the proper decision tools to critically, analytically, and creatively solve problems and drive results

Reference Books:

1. Wastewater Engineering Treatment and Reuse – Metcalf and Eddy
2. Theory and Practice of Water and Wastewater Treatment – Ronald Droste
3. Physio-Chemical Processes and Water Purification – Weber
4. Wastewater Treatment for Pollution Control – Soli Arceivala

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Subharti Institute of Technology and Engineering

Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: WATER SUPPLY SYSTEMS

EECC-103

Objective: *Identify The Sources And Quantity Of Surface And Ground Water Bodies And Their Demand For The Public And Also To Study The Quality Of Water And Their Treatment Techniques.*

Unit 1: Necessity and Objectives of Public Water Supply Schemes, Planning and Financing, Water Requirements, Continuous and Intermittent Supply, Water Demand, Variations in Rate of Demand, Its Effect on water table, Estimating the Quantity of Water Required.

Unit 2: **Hydrological Concepts and Sources of Water:** Hydrological Concepts, Hydrological Cycle, Sources of Water intakes, Types of intakes, Infiltration Galleries, Infiltration Well, Types of Wells, Sanitary Protection of Wells.

Unit 3: **Quality of Water and Transportation of Water:** Quality of Water, Portable Water and Mineral Water, Contamination of Water, Sampling Techniques, Physicochemical and Bacteriological analysis of Water, Water Borne Diseases, quality standards for drinking and wastewater, Transportation of Water.

Unit 4: **Purification of Water:** Working Principles of all the Unit Process of Water Treatment, Settling Operation, Softening, Filtration, Disinfection, Desalination, Dissolved Solids Removal, Adsorption and Ion Exchange, Electrolysis, Osmosis, Groundwater Remediation, Sorption and other chemical reactions, Flow and transport in the Unsaturated Zone.
Water Harvesting: Types of storage structures, water yield from catchments, runoff diversion, pond and reservoirs, earth embankments.

Unit 5: **Other Treatments and Distribution of Water:** Removal of Iron and Manganese, Fluoridation and defluoridation, Distribution of Water : Planning, Methods of Distribution, Service Reservoirs, Requirements of Good Distribution System, Layout of Distribution System, Net Work Analysis, Preventive Methods To Reduce Wastage of Water,

Outcomes: *The Students Completing the Course Will Have*

An Insight into The Structure Of Drinking Water Supply Systems, Including Water Transport, Treatment And Distribution

An Understanding of Water Quality Criteria And Standards, And Their Relation To Public Health,

The Ability to Design And Evaluate Water Supply Project Alternatives On Basis of Chosen Selection Criteria

Reference Books:

1. Garg, S.K., "Water Supply Engineering", Khanna Publishers, Delhi, September 2001
2. Punmia B.C, Arun K.Jain, Ashok K.Jain, "Water Supply Engineering" Lakshmi Publication Private Limited, New Delhi, 1998.
3. Birdie G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai And Sons, 1991.
4. Fair, G.M., Geyer, J.C., "Water Supply And Wastewater Disposal", John Wiley And Sons, 1954.
5. Babbitt, H.E, and Donald, J.J, "Water Supply Engineering", McGraw Hill Book Co, 1984.
6. Steel, E.W. et al., "Water Supply Engineering", Mc Graw Hill International Book Co, 1984.
7. Duggal, K.N., "Elements of Public Health Engineering", S. Chand and Company Ltd, New Delhi, 1998.
8. Mark J. Hammer & Mark J. Hammer Jr., "Water and Waste Water Technology", Prentice Hall Of India Pvt. Ltd., New Delhi, 2008.
9. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw Hill, 1984
10. Viessman Jr, Hammer J. M, Perez, E.M, and Chadik, P. A, Water Supply and Pollution Control, PHI Learning, New Delhi, 2009



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Department of Environmental Engineering
Course: M.Tech (Environmental Engineering & Management)

ENVIRONMENT POLLUTION & SUSTAINABLE DEVELOPMENT
Code: (EEDE-115)

Objective:

- To understand the types, sources, and impacts of environmental pollution on ecosystems, human health, and climate.
- To analyze major environmental challenges and evaluate their links to population growth, resource use, and industrial development.
- To explore principles and strategies of sustainable development, including pollution control, waste management, and renewable resource use.
- To promote environmental responsibility by encouraging sustainable practices, informed decision-making, and awareness of environmental policies.

Unit 1: Introduction to Environment and Ecology, Global Environmental challenges and its impact, Environmental changes and its consequences, Impact of Environment pollution on Human health, Social issues and impact of Environment, Fundamentals of earth's Sphere, Introduction to Natural Resources, Use of natural Resources and its environmental impact, Principles of Conservation of Natural Resources

Unit 2: Fundamentals of Ecosystem, Food Web, Food Chain, Niche, Ecological Pyramids, Introduction to Natural Resources, Use of natural Resources and its environmental impact, Overexploitation of Natural Resources and its impact, Levels of Biodiversity and Causes of Biodiversity Loss, Concept of Mega diversity, Threats to Biodiversity, Biodiversity Conservation.

Unit 3: Environmental Pollution, Types and Sources of Environmental Pollution. Direct and Indirect Impact of Pollution on environment and society, Prevention and Control of Pollution

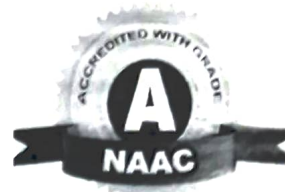
Unit 4: Hazard and Disaster: Tsunami, Flood, Earthquake, Natural and manmade disasters, Tsunami 2004: A Case Study, The Bhopal Gas Tragedy: A Case Study, Disaster management, Control, prevention and Mitigation of disaster. Concept of Environment Regulation, Environment Regulation in India, Nuclear Hazards, Industries & Waste Management

Unit-5: Ethics of Environmental Education, Environmental Values. Sustainable Environment Development, Environment Remediation Concept, Sustainable Agriculture and Environment Remediation, Biofuels, Sustainable Urban development





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Outcomes:

- Understand the basic concepts of environment and ecology, global environmental challenges, and their socio-economic impacts.
- Recognize the importance of natural resources, their sustainable use, conservation principles, and the consequences of their overexploitation.
- Comprehend ecosystem functioning, biodiversity significance, threats, and conservation strategies.
- Analyze different types of environmental pollution, their sources, impacts, and prevention methods.
- Evaluate natural and man-made disasters, disaster management techniques, and case studies of major environmental tragedies.

References:

- Rao, C.S. Environmental Pollution Control Engineering
New Age International Publishers Edition: Revised Second Edition, 2006 ISBN: 9788122418354
A comprehensive book covering types of pollution, control technologies, and regulatory frameworks.
- Masters, G.M., & Ela, W.P. Introduction to Environmental Engineering and Science Publisher: Pearson Education Edition: 3rd Edition, 2008 ISBN: 9780131481930
Focuses on scientific principles, environmental chemistry, pollution, and sustainability approaches.
- Botkin, D.B., & Keller, E.A. Title: Environmental Science: Earth as a Living Plane Publisher: Wiley Edition: 9th Edition, 2014 ISBN: 9781118427323
A balanced book covering ecology, pollution, environmental problems, and policy solutions.
- Mackenzie, F.T., & Mackenzie, J.A. Title: Our Changing Planet: An Introduction to Earth System Science and Global Environmental Change Publisher: Pearson Edition: 6th Edition, 2014 ISBN: 9780132857123
Discusses global environmental change, climate change, and sustainability.
- Kumar, P. Title: Ecology and Environment Publisher: Pathfinder Publications Edition: Latest Edition
Popular in Indian universities for coverage of ecology, biodiversity, pollution, and environmental management.





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Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)

Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
Ph.: 0121-2439157, Ext. 2222, 2221, Fax: 0121-2439108
E-mail: principal.site@gmail.com, principal.engg@gmail.com, Website: www.subharti.org



Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

INDUSTRIAL WASTE MANAGEMENT

Code: EEOE-541

Objective: To impart knowledge on the concept and application of Industrial pollution prevention, technologies, industrial wastewater treatment and residue management.

- Understand principles of various processes applicable to industrial wastewater treatment
- Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

Unit-1: Introduction: General Characteristics of Industrial Effluents, Effects on Environment - ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and onto land for irrigation - Toxic chemicals from industry.

Unit-2: Pretreatment Of Industrial Wastewater: Necessity of pretreatment - Equalization - Segregation - Process Changes - Salvaging - By product Recovery. Removal by Reverse Osmosis, Ion Exchange, Electrodialysis, Solvent Extraction, Floatation, Removal of Refractory Organics - Removal of Nitrogen and Phosphorus.

Unit-3: Major Industrial Effluents: Sources, Characteristics and Treatment. Food Industries: Sugar, Dairy, Distilleries

Unit-4: Chemical Industries: Paper and Pulp, Tanneries, Textiles, Fertilizers, Pharmaceuticals, Cement and Steel.

Outcomes:

- Sample and analyze the characteristics of industrial wastewaters.
- Analyze the effects of disposal of industrial wastes
- Identify and design treatment options for handling industrial wastewater.
- Identify and design treatment options for handling industrial wastewater.

Reference Books:

1. Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008
2. Numersorn, N.L., Liquid Waste from Industry – Theories, Practice and Treatment, Addison-Wesley, 1971
3. Patwardhan, A.D., Industrial Waste Water Treatment, PHI Learning, 2009 Rao, M.N., and Dutta, A.K., Wastewater Treatment, IBH Publ., 1995

Manoj Kapil





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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: VALUE EDUCATION

Code:EEHM-114

Objectives: *Understand value of education and self-development. Imbibe good values in students. Let the students know about the importance of character.*

Unit-I: Values and self-development, Social values and individual attitudes, Work ethics, Indian vision of humanism. Moral and non-moral valuation, Standards and principles, Value judgments,

Unit-II: Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity. Patriotism, Love for nature, Discipline

Unit-III: Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature

Unit-IV: Character and Competence - Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control. Honesty, studying effectively

Outcomes: *Knowledge of self-development*

Learn the importance of Human values

Developing the overall personality

Reference Books:

Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

M.Tech (Environmental Engineering & Management)

Subject: WATER SAMPLING AND TESTING

Code: EEPC-151

Objective: The laboratory is to determine the qualities of water and waste water characteristics for the measurement of waste water and pollution level.. This laboratory course will help the students to understand the concepts learned in the course of water & wastewater engineering.

- Experiment No.1: Estimation of Solids, Acidity, Alkalinity, Hardness, Chlorides and Fluorides
Experiment No.2: Determination of pH and Conductivity
Experiment No.3: Estimation of Dissolved Oxygen
Experiment No.4: Total Hardness and Carbonate Hardness in water sample.
Experiment No.5: Estimation of Nitrogen (Different Forms like Nitrite, Nitrate)
Experiment No.6: Estimation of Phosphates and Sulphates
Experiment No.7: Estimation of Residual Chlorine
Experiment No.8: Determination of Available Chlorine in bleaching powder
Experiment No.9: Determination of Total Solids, Suspended & Dissolved Solids in a given sample of sewage
Experiment No.10: Determination of Residual Chlorine
Experiment No.11 Determination of Chemical Oxygen Demand of a given sample of sewage.
Experiment No.12 Determination of Bio-Chemical Oxygen demand of a given sample of sewage.
Experiment No.13: Determination of Heavy Metals

Outcomes:

Students have been taught the lab experiments as per syllabus.

Practical Knowledge of field

Reference books:

1. Manual on water and waste water analysis by NEERI
2. Manual on water and waste water analysis by APHA
3. Wastewater Engineering Treatment and Reuse – Metcalf and Eddy
4. Theory and Practice of Water and Wastewater Treatment – Ronald Droste



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M.Tech (Environmental Engineering & Management)

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4. Theory and Practice of Water and Wastewater Treatment – Ronald Droste

Manoj K. Patel
Dean
Faculty of Engineering & Technology



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Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: UNIT OPERATION & PROCESSES

Code: EEDE-111

Objective: To provide the knowledge about various unit operations and processes used in wastewater treatment techniques

Unit 1: Introduction: Concept of unit operations, Standard & requirements, water treatment process & system, waste water treatment process & treatment REACTORS: A simplistic view of reactors. Homogeneous reactions, Non homogenous reactions Effectiveness factor models. Continuous homogeneous reactors, conversion, Non homogeneous reactors, Problems

Unit 2: Chemical & Biological Unit Processes: Chemical precipitation – phosphate removal – Adsorption – Activated carbon – Isotherms – Disinfection – principles – types of chlorination – De-chlorination. Principles of Biological growth – Suspended and attached growth processes.

Unit 3: Physicochemical Removal of Dissolved Materials : Adsorption, Ion exchange Membrane processes, chemical oxidation, precipitation, problems Gas Transfer: Mass-Transfer models, Bubble aeration, temperature effects.

Unit 4: Disinfection: Objectives, Different Types, Chlorinator (Advantages & Disadvantages), Bleaching Powder, Ozone Treatment, UV Irradiation, Types of Chlorination, Breakpoint chlorination, de-chlorination.

Unit 5: Aerobic and Anaerobic: Activated sludge, process parameter, mass transfer limitations on removal rate, cell yield, process operation performance and control, extended aeration process, step aeration, high rate activated sludge, bio sorption on contact stabilization, pure-oxygen-activated sludge – aerated lagoons, aerobic digestion, centrifugal screen, nitrification, anaerobic bacterial denitrification, oxidation lagoons, problems, Biological Film Flow Process: Trickling filter, development of a design equation maximum influent concentrations, airflow rate, physical factor in trickling filter design, rotating biological contractor, references.

Outcomes:

*Developments of knowledge in the specific field of practice
To design water and wastewater treatment facilities
To understand and analyze the urban hydrological cycle and its components
To acquire knowledge regarding wastewater reuse and its challenges*

Reference Books:

1. Waste Water Treatment by Edward
2. Unit Operation in Environmental Engg by R. Elangovan
3. Design of anaerobic processes for the treatment of industrial and municipal wastes by Joseph F. Malina
4. Waste water Engg by Metcalf and Eddy
5. Elements of Chemical Reaction Engg by H. Scott. Fogler
6. Dynamics of Environmental Bio-processes by J.B. Snape and IJ Dunn

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Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: WATER AND WASTE WATER TREATMENT

Code: EEDE-112

Objective :To provide the knowledge about various steps (Primary, Secondary and Tertiary treatment) which are used in wastewater treatment process.

- Unit 1:** Water Treatment: Treatment: Introduction: Quality standard of domestic and industrial water, source classification of water pollutants, Sedimentation: Principle of sedimentation, Design of sedimentation tank, Design example of sedimentation tank. Coagulation: Coagulation process, the constituents of coagulation-sedimentation plant, Flocculation process, methods of determining optimum coagulation dose.
- Unit 2:** **Wastewater Treatment :**Design of wastewatertreatment plant units – screen chamber, Grit chamber with proportional flow weir, sedimentation tank, Trickling filters (standard rate, high rate); Rotating Biological contactor, activated sludge process, oxidation ditches, aerated lagoons, waste stabilization ponds – hydraulic profile and layout of primary and secondary nits – Anaerobic treatment systems, septic tank and disposal system, Sludge management, Sludge thickening, sludge digestion, sludge dewatering (mechanical and gravity) Sludge drying; Composting.
- Unit 3:** **Design Of Biological Units :**Attached and suspended growth, Design of units - UASB, up flow filters, Fluidised beds - septic tank and disposal - Layout and Hydraulic profile - Recent advances.
- Unit 4:** **Design of Sludge Units:** Design of Sludge management facilities, sludge thickening, sludge digestion, Biogas generation, sludge dewatering (mechanical and gravity) - upgrading existing plants - ultimate residue disposal - Recent Advances.
- Unit 5:** **Filtration :**Headloss through filters, Type of filters, Slow sand filter, Rapid sand filter, Pressure filter, filter media, components, Filter operation, cleaning and backwashing process the under drain system and filter control, Design examples

Outcomes:

- Developments of knowledge in the specific field of practice.*
Ability to understand the sources and characteristics, Effects of Discharges of Industrial Waste on receiving bodies of water
Ability to understand the Specific Industrial treatment Processes
Ability to understand the methods of treatment of Industrial Wastewater
Ability to understand the methods Potentials for Wastewater recycle and reuse in industries.

Reference Books:

1. Waste water engineering: Treatment, Disposal and reuse by Metcalf and Eddy
2. Water supply and sewage by Terence J. Mc.Ghee
3. Industrial water pollution control by W. Wesley and Eckenfelder, jr.
4. Water works Engg. by Qasim, S.R., Motley and E.M. Zhu.G.
5. Water supply and sanitary Engg by G.S. Birde and J.S. Birde
6. Water supply, Waste disposal and Environmental Engg by A.K. Chatterjee
7. Basic Environmental Technology by Jerry.A. Nathanon

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Department of Environmental Engineering

M.Tech (Environmental Engineering & Management)

Subject: BIOMEDICAL ENGINEERING

Code: EEDE-118

Objectives: *To learn about Specifications of bio-medical instrumentation system To learn about Cardiovascular Measurements To learn about Respiratory system Measurements*

- Unit-1** Introduction: Specifications of bio-medical instrumentation system, Man-Instrumentation system Components, Problems encountered in measuring a living system. Basics of Anatomy and Physiology of the body. Bioelectric potentials: Resting and action potentials, propagation of action potential, The Physiological potentials – ECG, EEG, EMG, ERG, EOG and Evoked responses Electrodes and Transducers: Electrode theory, Biopotential Electrodes – Surface electrodes, Needle electrodes, Microelectrodes. Biomedical Transducer
- Unit-2** Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes and Leads, ECG recorders – Single channel, Three channel, Vector Cardiographs, ECG System for Stresses testing, Holter recording, Blood pressure measurement, Heart sound measurement. Pacemakers and Defibrillators. Patient Care & Monitoring: Elements of intensive care monitoring, displays, diagnosis, Calibration & Reparability of patient monitoring equipment.
- Unit-3** Respiratory system Measurements: Physiology of Respiratory system .Measurement of breathing mechanism – Spirometer. Respiratory Therapy equipments: Inhalators, Ventilators & Respirators, Humidifiers, and Nebulizers & Aspirators. Nervous System Measurements: Physiology of nervous system, Neuronal communication, Neuronal firing measurements.
- Unit-4** Ophthalmology Instruments: Electroretinogram, Electrooculogram, Ophthalmoscope, Tonometer for eye pressure measurement. Diagnostic techniques: Ultrasonic diagnosis, Ecocardiography, Ecoencephalography, Ophthalmic scans, X-ray & Radio-isotope diagnosis and therapy, CAT-Scan, Emission computerized tomography, MRI.
- Unit-5** Bio-telemetry: The components of a Bio-telemetry system, Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Prosthetic Devices and Therapies: Hearing Aides, Myoelectric Arm, Dia-thermy, Laser applications in medicine.

Outcomes:

To understand Specifications of bio-medical instrumentation system – ECG, EEG, EMG, ERG, EOG etc

To understand about Cardiovascular Measurements

To understand about Respiratory system Measurements

To understand about Ophthalmology Instruments

To understand about Bio-telemetry

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REFERENCE BOOKS:

1. Cromwell- Biomedical Instrumentation and Measurements- PHI
2. Webster, J.G. -Bio- Instrumentation, Wiley (2004)

M.Tech (EEM)





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Manoj Kapur
DEAN
Faculty of Engineering & Technology



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Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

WASTE TREATMENT SYSTEMS

Code: EEDE-113

Objective: To impart knowledge on the relevance and applications of waste water system and related problems.

Unit-1: Introduction: Wastewater Characteristics, Standards of Disposal, Treatment Objective and, Strategies, Layouts of Primary, Secondary and Advanced Treatment Units.

Unit-2: Design of Preliminary and Primary Treatment Operations: Screens, Grit Chambers, Skimming Tank, Primary and Secondary Sedimentation Tanks.

Unit-3: Biological Treatment Processes: Types, Kinetics of Plug Flow and Completely Mixed Systems.

Unit-4: Attached Growth Processes: Trickling Filters (Standard Rate, High Rate), Biofilters, Practices, Features and Design, Operational Difficulties and Remedial Measures, Rotating Biological Contactors.

Unit-5: Suspended Growth Processes: Activated Sludge Process, Modifications and Design Equations, Process Design Criteria, Oxygen and Nutrient Requirements - Classification and Design of Oxidation Ponds, Lagoons. Sludge Treatment And Disposal: Sludge Thickening, Aerobic and Anaerobic Sludge Digestion Processes, Design of Digester Tank, Sludge Dewatering, Ultimate Disposal, Sludge Drying Beds, Other Methods of Sludge Treatment.

Outcomes:

- Identify and assess the characteristics of wastewater and their impacts
- Plan and design the components of wastewater treatment systems
- Understand underlying principles of processes involved in secondary wastewater treatment systems
- Design sludge treatment and disposal methods.

Reference Books:

1. Benefield L.D. and Randall C.D., *Biological Process Designs for Wastewater Treatment*, Prentice Hall Pub. Co., 1980
2. Metcalf and Eddy, *Wastewater Engineering—Collection, Treatment, Disposal and Reuse*, 4th Ed., McGraw Hill Pub. Co., 2003

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Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

ENVIRONMENTAL POLICY

Code: EEDE-117

Objective: To impart knowledge on the policies, legislations, institutional frame work and enforcement mechanisms for environmental management in India.

- Unit-1: Introduction:** Economics and Environmental Policy Theory of externalities: Relevance. Externalities: definitions, significant types, and optimal pricing conditions, formal analysis
- Unit-2: Uncertainty and choice of policy instruments:** price or quantity controls, Market imperfections and the number of participants.
- Unit-3:** Detrimental externalities and non-convexities in the production set, optimal pricing of exhaustible resources Introduction to design of Environmental policy. Efficiency without optimality: the charges and standard approaches.
- Unit-4:** Marketable emission permits for the protection of the environment. Stochastic influences, direct controls, and taxes, Taxes vs subsidies: a partial analysis, Environment protection and the distribution of income.
- Unit-5:** International environmental issues, National and local standards for environmental quality

Outcomes:

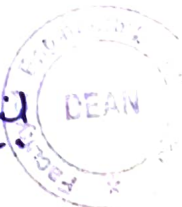
- Describe national and international policy issues related to environmental media.
- Understand existing environmental laws and regulation.
- Assess influence of policy decisions on the environment.
- Apply knowledge of environmental analysis in planning and policy making.

Readings:

1. Baumol, W. J. and Oates, W. E. "The theory of environmental policy", Cambridge: Cambridge University Press, 1988
2. Dixon, J. Economic Analysis of Environmental Impacts. London: Earthscan Publications, 1994
3. Mehta, S.; Mundle, S. and Sankar, U. Incentives and regulation for pollution control. Sage Publishers, 1997
4. Bohm, P. and Russell, C. "Comparative analysis of alternative policy instruments", in Allen Kneese, V. and Sweeney, J.L. (eds.) Handbook of natural resource and energy economics. North Holland, 1985

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Manoj Kapi





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Course: M.Tech (Environmental Engineering & Management)

Subject: WATER RESOURCES MANAGEMENT

Code: EEDE-120

Objectives : *Understand the basics of water resources planning and management,*

- Unit 1:** Introduction: Water Resources planning, multi-objective planning role in national development, basic concepts of hydrology and hydrogeology. River monitoring, gauging silting, silt load etc.
- Unit 2:** Ground water pollution. National water policy. Water Resources planning and processes: Management of water bodies.
- Unit 3:** Application of Remote-sensing Techniques. Integrated approach – carrying capacity based planning. Water resources conservation: quantity aspects, surface and ground water development,
- Unit 4:** Rainwater harvesting, Ground water Recharge, conjunctive use of ground and surface water Water resources development in coastal areas. Basic concepts of economics, welfare economics.
- Unit 5:** Inter basin transfer of water. EIA of water Resource development projects.

Outcomes:

Knowledge of field water resource and management
Knowledge of Remote-sensing Techniques

Reference Book

1. Linsley R.K. & Franzini, J.B.; Water resources Engineering. McGraw Hill 1979.
2. Grigg N.S. Water Resources planning McGraw Hill Book company.

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Subject: WATER RESOURCES MANAGEMENT

Code: EEDE-120

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Manoj Kapil





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Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: ENVIRONMENTAL SANITATION AND HYGIENE

Code: EEDE-119

Objectives :

- To understand the principles of environmental sanitation and hygiene, including waste management, water safety, and disease prevention.
- To identify and evaluate public health risks arising from poor sanitation, unsafe water, and unhygienic living conditions.
- To develop practical skills and strategies for promoting hygiene practices, improving sanitation systems, and ensuring a healthy environment in communities.

Unit 1 – Fundamentals of Environmental Sanitation and Hygiene, Basic Concepts: Definition, scope, and importance of sanitation and hygiene in environmental engineering, Link to Public Health: Waterborne, airborne, and vector-borne diseases; role of sanitation in disease prevention, Environmental Health Indicators: Morbidity and mortality rates, DALYs, WHO sanitation classifications, Hygiene Principles: Personal hygiene, domestic hygiene, community hygiene, occupational hygiene, Historical Development: Sanitation evolution from ancient civilizations to modern infrastructure, Global and National Perspectives: UN Sustainable Development Goals (SDG 6 – Clean Water & Sanitation), Swachh Bharat Mission, WHO and UNICEF guidelines.

Unit 2 – Water Supply, Quality, and Sanitation Interface, Safe Drinking Water Criteria: Physical, chemical, and microbiological parameters, Waterborne Diseases: Cholera, typhoid, hepatitis, diarrhea – causative agents, transmission pathways, prevention strategies, Drinking Water Treatment & Hygiene: Multi-barrier approach – source protection, treatment, and safe storage, **Sanitary Surveys:** Purpose, methodology, and interpretation, Point-of-Use Water Treatment Technologies: Boiling, chlorination, filtration, solar disinfection, biosand filters, Hygienic Water Handling Practices: Household-level interventions to prevent contamination.

Unit 3 – Solid and Liquid Waste Management for Hygiene Promotion, Human Excreta Disposal: Types of toilets – pour-flush, septic tanks, ecological sanitation, dry composting toilets, Sullage and Greywater Management: Separation, reuse, and treatment options, Solid Waste Management: Segregation, collection, transportation, and disposal; role in sanitation and hygiene, Wastewater Sanitation: Link between improper wastewater disposal and public health impacts, Sludge and Fecal Sludge Management: Hygienic collection, treatment, and safe disposal/reuse, Community Sanitation Systems: Low-cost sanitation technologies for rural and urban settings.

Unit 4 – Vector Control, Environmental Hygiene, and Occupational Health, Vectors of Public Health Importance: Mosquitoes, flies, rodents – breeding habitats, control strategies, Vector-Borne Disease Control: Malaria, dengue, chikungunya, leptospirosis, Environmental Hygiene in Public Places: Schools, hospitals, markets, slums, transport hubs, Food Hygiene and Sanitation: Safe food handling, HACCP basics, prevention of foodborne illnesses, Occupational Health & Hygiene: Workplace sanitation, PPE usage, sanitation for waste handlers, Disaster Sanitation: Sanitation measures during floods, earthquakes, refugee camps, and emergencies.

Manoj K...



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Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)



Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)

Ph.: 0121-2439157, Ext. 2222, 2221, Fax: 0121-2439108

E-mail: principal.site@gmail.com, principal.engg@gmail.com, Website: www.subharti.org

Unit 5 – Monitoring, Policy, and Emerging Issues in Sanitation and Hygiene, Sanitation & Hygiene Monitoring Tools: Indicators, sanitary inspection forms, participatory approaches, Microbiological Monitoring: Indicator organisms, rapid test kits, culture-based and molecular methods, Policies & Legal Framework: Indian sanitation laws, environmental health acts, WHO water safety plans, Case Studies: Urban slum sanitation interventions, Rural hygiene campaigns in India, Cholera outbreak control through improved sanitation, Recent Advances: Smart sanitation systems, IoT-based monitoring, container-based sanitation, menstrual hygiene innovations, Emerging Concerns: Antimicrobial resistance and sanitation, climate change impacts on sanitation infrastructure.

Outcomes

- Understand the relationship between sanitation, hygiene, and public health.
- Identify and design hygienic sanitation systems for different settings.
- Evaluate the role of water, waste, and vector control in disease prevention.
- Apply sanitation and hygiene principles in disaster and emergency scenarios.
- Assess emerging sanitation challenges and modern technological solutions.

Reference Books

1. Mara, D. – *Environmental Sanitation and Health Engineering*
2. Feachem, R.G., Bradley, D.J., Garelick, H., Mara, D.D. – *Sanitation and Disease: Health Aspects of Excreta and Wastewater Management*
3. WHO – *Guidelines on Sanitation and Health*
4. Tilley, E. et al. – *Compendium of Sanitation Systems and Technologies*
5. Curtis, V., Cairncross, S. – *Hygiene in the Home and Community*
6. APHA, AWWA, WEF – *Standard Methods for the Examination of Water and Wastewater*

GKP

Mr

Manoj Kapil





Subharti Institute of Technology and Engineering
Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)



Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)

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Department of Environmental Engineering
**Syllabus of M.Tech Environmental
Engineering and Management (EEM)**

SECOND SEMESTER

M.Tech

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Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)

Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering
Department of Environmental Engineering
Course: M.Tech (Environmental Engineering & Management)

Subject: AIR POLLUTION CONTROL

EECC-201

Objective: *The basic principles followed for eliminating negative impacts on the quality of air. The course emphasis on control and prevention of air pollution by providing knowledge about Meteorology and methods of controlling of air pollution*

Unit 1: Introduction: Definition, Sources and classification of Air Pollutants: Natural contaminants-aerosol – gases and vapour. Air quality standards, air quality, classification of air pollutants, air pollution episodes. Air pollution Sources and their Inventory: Particulate matter, carbon dioxide, carbon monoxide, oxides of sulphur, oxides of nitrogen, hydrocarbons, photochemical oxidants, asbestos and metals.

Unit 2: Meteorology and Dispersion of Pollutants: Winds, wind rose, maximum mixing depth, lapse rate, stability conciliations, plume behavior, calculation of effective stack height, The Gaussian dispersion model, heat island effect.

Unit 3: Air Pollution Monitoring: Sampling of gaseous and particulate air pollutants, Measurement of SO₂, Nitrogen oxides, Carbon monoxide, Oxidants and Ozone, Hydrocarbons and particulate matter PM₁₀ & PM_{2.5}. Effect of Air Pollution: Effect of air pollution on humans, animals, vegetation and materials.

Unit 4: Control of Air Pollution: General methods of control of Gaseous pollutants- scrubbers, condensers, control equipment's for particulate matter, gravity settling chambers, cyclone, fabric filters, electrostatic precipitators, scrubbers, Incinerator and catalytic converters (their design, operation and application).

Unit 5: Green belt development, Strategy for effective control of air pollution in India.

Outcomes:

*Ability to understand the various sources of air pollution and their classification
Knowledge about Emission inventories & Emission factor
Ability to understand about Economic Effects of air pollution*

Reference Books:

1. Air Pollution and Control by K.V.S.A. Murali Krishna
2. Environmental Air Pollution and control by G.R. Chhatwal, T.Katyal and Mohan Katyal
3. Environmental Chemistry by Mammahan
4. Introduction to Environmental Engineering and Science by Gilbert M. Masters
5. Air Pollution & Control by C.S.Rao
6. Air Pollution by Boubel Fox, Turner & Stern.

Manoj Kapil





Subharti Institute of Technology and Engineering

Swami Vivekanand Subharti University, Meerut

(Approved by AICTE)

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E-mail: principal.site@gmail.com, principal.engg@gmail.com, Website: www.subharti.org



Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject : NATURAL RESOURCES AND BIODIVERSITY

Code: EECC-202

Objectives: To multidisciplinary knowledge about natural resources management related to the research within the specialization
To knowledge in a specific area based upon research experience from a masters project to knowledge about various methodological and analytic approaches that are used within the specialization

Unit 1: Introduction to Natural Resource Bases: Concept of resource, classification of natural resources, Factors influencing resource availability, distribution and uses, Interrelationships among different types of natural resources. Concern on Productivity issues, Ecological, social and economic dimension of resource management.

Unit 2: Energy resources: Renewable & non-renewable resources, Fossil fuels, nuclear energy, solar energy, wind energy, tidal energy, geothermal energy, hydropower. Hydrogen as a source of energy, energy from biomass, bioconversion technology, energy plantations and petro-crops, Environmental impacts of various forms of energy use.

Unit 3: Biological resources: forests, their importance, types, primary and secondary products -value & uses, forest resources of India, Wild-life of India, and convention on biodiversity (CBD).
Soil resources: soil type, soil profile and soil erosion. Water resources: Surface water, ground water, hydrological cycle. Mineral resources: Types, their characteristics & uses, minerals from the sea.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources
Poverty and implications in Resource Management in developing countries: Poverty in developing countries causes and link with resources scarcity and poverty.

Unit 4: Biodiversity: Definition, Types of diversity, threats to biodiversity and species extinction, threatened and endangered species, hot spots of biodiversity, Calculation of alpha, beta and Gamma biodiversity
Biodiversity conservation strategies: National parks, wild life sanctuaries, biosphere reserves, gene banks, germ plasma Banks, Zoo.

Unit 5: Biodiversity Conservation: in situ and ex situ conservation, Biodiversity trends, diversity gradients and related hypotheses methods for monitoring biodiversity trends. Mega diversity zones and hot spots, Biodiversity valuation, goods and services provided by biodiversity, Threats to biodiversity, major causes, extinctions, vulnerability of species to extinction, IUCN threat categories, Red data book, Principles and strategies of biodiversity conservation

Outcomes:

Describe ecological processes, including human impacts that influence ecosystems change, natural succession and the future sustainability of natural resources.

Characterize natural resources and be able to quantify at least one of these resources.

Envision desired future conditions in an area to achieve a set of natural resource-related objectives, prescribe management actions needed to achieve those objectives, and evaluate success of these actions.

Describe how the use, management and allocation of natural resources are affected by: laws, policies, economic factors (both market and non-market), and characteristics (including demographic, cultural, ethnic, and "values" differences) of private and public resource owners and users.

Reference Books:

1. Natural Resources conservation-Oliver S Owen & Chiras
2. Living in the Environment -T.J.Miller
3. Environmental Science- Cunningham Saigo
4. Ecology of Natural Resources-Ramade
5. Global Biodiversity-W.R.L. IUCN
6. Soils-Miller, W & R.L. Donhau

Manoj Kapi





Subharti Institute of Technology and Engineering
Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)

Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: ENVIRONMENTAL POLICY AND IMPACT ASSESSMENT Code: EECC-203

Objective: The Environmental Impact Assessment EIA is very important for preventing environmental degradation and promoting a sustainable society. Its objective of course is to consider environmental protection properly by understanding a procedure for the EIA of a projects and the assessment results in the decision-making.

Unit 1: Introduction to EIA: Definition and objectives of EIA, purpose of EIA, terminology, hierarchy in EIA, basic data collection for EIA Legislation and framework: EIA legislative requirements and administrative procedures in India/Indian States, EIA notification of MOEF, 2006 National Environmental Policy Act and implementation

Unit 2: Public participation in environmental decision making: Regulatory requirements, techniques, advantages and disadvantages of public participation, managing a public hearing Impact assessment techniques and methodology: Description of the environmental setting, methods of impact analysis, environmental risk assessment, baseline data collection Prediction and assessment of impacts: Air- Gaussian plume model for air pollution assessment, water, noise, biological, cultural and socio-economic damage. Case studies of EIA for Industries: Oil, petrochemical, fertilizer, sugar and distilleries, mining industries (iron and steel, cement industry) Case studies of development: Roads, dams and housing, denial cases for development projects based on EIA clearance.

Unit 3: Environment Management Plan: Planning, selection of appropriate procedures, introduction to budget, minimizing environmental impacts The Environmental Audit: Environmental auditing and its importance, types of audits, general audit methodology and basic auditing structure, ISO14000 requirements of Rule 14 for Environmental Audit under Environmental Protection Act of 1986, definitions of. Consumption audits, pollution audits, hazardous issues audits, voluntary audits.
Case studies: Thermal power plant, refineries and water reservoir.

Unit 4: Environmental Policy and Laws: Common environmental laws, their historical perspective & constitutional provision for environmental protection. Some laws for environmental protection e.g. Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and Control of Pollution) Act, 1981, Environmental (Protection) Act, 1972, Forest Conservation Act, 1980; National Forest Policy Act 1988; Wild Life (Protection) Act, 1972, Public Insurance & Liabilities Act, 1991.

Unit 5: Environmental Conventions and Treaties: Stockhome Conference, The Rio Earth Summit, 1992; Convention on climate change; Agenda-21; Montreal Protocol, Kyoto Summit, 1997; World on sustainable development, 2002; Movements (Chipko, Apiko and Khejarli Ka Khadana).

ISO 14000: Environmental Management Plan: The evolution of Environmental Management Standards, ISO 14000 implementation, preparation of documentation, internal auditing compliance, Eco-labeling communication to the public.

Outcomes

Developments of knowledge in the specific field of practice

To understand Environmental laws, different regulations policies and/or Executive orders related to Physical, Chemical, and Biological, Cultural.

To understand the interpretation of existing environmental conditions It provides a basis for interpreting the anticipated impact of the Project.





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Reference Books:

1. Larry W. Canter: Environmental Impact Assessment
2. Glasson T: Environmental Impact Assessment
3. Petter Morris: Environmental Impact Assessment
4. Eceleston, C.H.: Environmental Impact Assessment
5. Paras Dewan: Environmental Administration Law & Judicial Attitude
6. K.c. Aggarwal: Environmental Law
7. Revesy . R., Sands, P & Stewarts, B: Environmental Law and sustainable Development
8. Khanna, P.: Primer on Environmental Management

M.Tech (EEM)

Manoj Kapil



Subharti Institute of Technology and Engineering
Swami Vivekanand Subharti University, Meerut
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Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: SOLID AND HAZARDOUS WASTE MANAGEMENT **Code: EEDE-215**

Objective: To identify and classify solid and hazardous wastes, explain the techniques of solid and hazardous waste management, treatment, minimization and recovery.

Unit 1: Introduction: Types, source and characteristics of solid wastes. Solid waste generation, handling and storage, Collection of solid waste, collection services, types of collection system and their analysis, transfer and transport, Solid waste management, reduction, reuse, and recovery.

Unit 2: Transfer, Transport and Processing Techniques: Need for transfer operation, transport means and methods, transfer station types and design requirements. Landfills: Site selection, design and operation, drainage and leachate collection systems – requirements and technical solution, designated waste landfill remediation Integrated waste management facilities, Shredding, pulverizing, baling, component separation, incineration, gasification, and pyrolysis.

Unit 3: Disposal: Dumping, land filling- site selection, Leachate contamination, land filling methods, design and operation of landfills occurrence and movement of gases and leachate in landfills, treatments of leachates, land farming and deep well injection.

Unit 4: Materials Recovery System: Processing of recyclable materials (case study of Somerset country materials recycling facility), metal recovery from solid wastes Recovery from biological conversion products: Aerobic and anaerobic conversion. Recovery of thermal conversion products: Energy recovery system, energy from food waste, animal waste potential. Biogas plant, Utilization of fly ash, Economics of waste disposal

Unit 5: Hazardous Waste Management: Hazardous waste treatment technologies - Design and operation of facilities for physical, chemical and thermal treatment of hazardous waste – Solidification, chemical fixation and encapsulation, incineration. Hazardous waste landfills: Site selection, design and operation – remediation of hazardous waste disposal sites, Techniques.

Outcomes:

Developments of knowledge in the specific field of practice

Knowledge about characteristics of solid waste and problems associated with solid waste disposal.

Knowledge about various methods of solid waste treatment

Reference Books:

1. Environmental Hazards- Smith, Keith
2. Environmental Hazards-Iqbal, M, Srivastava, A.S. and Siddiqui, T.Q.
3. Basic Environmental Technology-Nathanson, J.A.



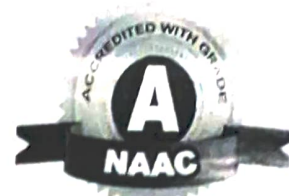


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Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)

Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: INSTRUMENTATION (Spectrometry & Chromatography) CODE: EEDE-216

Objectives: To provide knowledge in various instrumentation techniques used in analysis of water and air pollutants.

Unit 1: Principle of Spectrometry, Beer Lambert Law, Scope of Spectrometry, UV Spectrometry, IR Spectrometry.

Unit 2: Chromatography: Basic Principle and construction –Different types of columns – Detectors – Recorders and associated equipment. Industrial and laboratory applications of gas Chromatography, Principle of Chromatography, Types of Chromatography, Adsorption Chromatography; Paper Chromatography, Thin Layer Chromatography (TLC), Gas Liquid Chromatography (GLC), High Performance Liquid Chromatography (HPLC); High Performance Thin Layer Chromatography (HPTLC); Electrophoresis

Unit 3: Mass Detectors (MSD), Electron Capture Detector (ECD), Flame Ionization Detector (FID), Nitrogen Phosphorus Detector (NPD), Photo Diode Array Detector; Fluorescence detector; Photo-ionization detector Electrical Conductivity Detector; Electro Chemical Detector

Unit 4: Electrophoresis – Principle and applications; Techniques of Electrophoresis; Gel Electrophoresis; Poly Acrylamide Gel Electrophoresis (PAGE); Capillary Electrophoresis; Agrose Gel Electrophoresis

Unit 5: Flame Photometry, Atomic Absorption Spectrometry (AAS), Microwave Spectroscopy, Differential Thermal Analysis, Nuclear Magnetic Resonance (NMR); Fourier Transform infrared spectroscopy (FTIR); Raman Spectroscopy

Outcomes:

Students have been taught the lectures and tutorials as per syllabus.

Knowledge of field instrumentations

Application of control systems in processes

Reference Books:

1. Oliver Thomas and Christopher Burgess; UV-Visible Spectrometry of Water and Wastewater : A Practical Approach; Elsevier Science and Technology, 2007
2. Dimiter L Tsalev; Atomic Absorption Spectrometry in Occupational and Environmental Health Practice, Publ: CRC Press, Vol III, 1995
3. BK Sharma; Chromatography; Publ: Goel Publishing House, Meerut, 2007
4. Dunkan J Shaw; Electrophoresis; Academic Press, 1969
5. Roger S Macomber; A Complete Introduction to Modern NMR Spectroscopy; John Wiley & Sons, Inc, New York; 1998





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Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)



Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
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E-mail: principal.site@gmail.com, principal.engg@gmail.com, Website: www.subharti.org

Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
Course: M.Tech (Environmental Engineering & Management)

Subject: ENVIRONMENTAL BIOTECHNOLOGY

CODE:EEDE-211

Objective :

Unit -I Environmental Biotechnology – Principles and concepts –usefulness to mankind. Degradation of high concentrated toxic pollutants – halogenated non halogenated, petroleum hydrocarbons, metals- Mechanisms of detoxification – oxidation – dehalogenation- biotransformation of metals – biodegradation of solid wastes.

Unit -II Biotechnological remedies for environmental pollution- decontamination of groundwater bioremediation– Production of proteins- biofertilizers – Physical, chemical and microbiological factors of composting – health risk- pathogens- odor management.

Unit -III: Microbial cell/enzyme technology – adapted microorganisms – biological removal of nutrients – algal biotechnology – extra cellular polymers – Biogas technology.

Unit -IV: Concept of rDNA technology – expression vectors – cloning of DNA mutation – construction of microbial strains – radioactive probes – protoplast fusion technology applications.

Unit -V: Environmental effects and ethics of microbial technology – genetically engineered organisms – Microbial containment – Risk assessment.

Reference Books:

1. Chaudhury, G.R, Biological degradation and bioremediation of toxic chemicals, Dioscorides Press, Oregon, 1994.
2. Martin. A.M. Biological degradation of wastes, Elsevier Applied Science, London, 1991.
3. Blaine Metting .F (Jr.,) Soil Microbiology Ecology, Marcel Dekker Inc., 1993.
4. Wainwright, M, "An Introduction to Environmental Biotechnology", 2009

Manoj K. Singh





Subharti Institute of Technology and Engineering
Swami Vivekanand Subharti University, Meerut
(Approved by AICTE)



Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
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Swami Vivekanand Subharti University, Meerut
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Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: RESEARCH METHODOLOGY AND IPR (RM)

CODE: EE0E-227

Course Objectives

- To understand the fundamental principles of research methodology, including problem identification, literature review, research design, data collection, and analysis.
- To develop the ability to apply appropriate research tools and techniques for conducting scientific, technical, or academic research effectively and ethically.
- To gain knowledge of Intellectual Property Rights (IPR), including patents, copyrights, trademarks, and their role in protecting innovations and promoting research outcomes.

Unit I: Meaning of research problem, Sources of research problem, Criteria characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problems, Approaches of investigation of solutions for research problems, Data collection, Analysis, interpretation, and Necessary instrumentation.

Unit II: Effective literature studies approaches, Analysis plagiarism, and Research ethics

Unit III: Effective technical writing, Report and paper writing, developing a research proposal, Format of research proposal, Presentation and assessment by review committee.

Unit IV: Nature of Intellectual Property Right (IPR): Patents, Designs, Trade and Copyright, Process of patenting and development, technological research, innovations, patenting, International Scenario, international Cooperation's on Intellectual Property Rights, Procedure for grants of patents, Patenting under PCT.

Unit V: Patents rights, Scope of patents rights, Licensing and transfer of technology, Patent information and database, geographical indications.

Unit VI: New development in IPR: Administration of patent system, IPR of biological system, Computer software etc. traditional Knowledge, case studies, IPR and IIT's.

Outcomes:

To understanding the process of patenting

To expose the students on various aspects of report writing

To motivate the students for research

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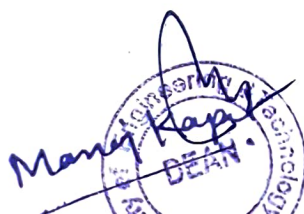
Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
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Reference Book:

1. Kumar, R. (2011). Research Methodolgy. SAGE Publications Asia-Pacific Pte Ltd. ISBN 978-1-84920-300-5
2. ISBN 978-1-84920-301-2 (pbk).
3. Mishra, S. B. and Alok, S. (2011) Handbook of Research Methodology: A Compendium for Scholars & Researchers. Educreation Publishing, New Delhi

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Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)
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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject : ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

CODE: EEDE-218

Course Objectives

- To understand the chemical principles governing environmental processes, including the composition, reactions, and transformations of pollutants in air, water, and soil.
- To study the role of microorganisms in environmental systems, focusing on microbial ecology, biodegradation, water quality, and pathogen control.
- To develop the ability to apply chemical and microbiological techniques for monitoring environmental quality, assessing contamination, and supporting sustainable environmental management.

Unit 1 – Fundamentals of Environmental Chemistry, Basic Concepts: Structure of matter, chemical bonding, stoichiometry, concentration units in environmental studies., Environmental Segments: Lithosphere, hydrosphere, atmosphere, biosphere – composition and chemical processes., Water Chemistry: pH, alkalinity, hardness, redox potential, buffering capacity, Chemical Kinetics & Equilibria: First and second order reactions, Henry's law, partition coefficients. Colloidal Chemistry: Stability of colloids, coagulation-flocculation chemistry, Speciation & Complexation: Inorganic speciation, metal-ligand interactions in natural waters, Important Cycles: Carbon, nitrogen, phosphorus, and sulfur cycles – chemical transformations in nature.

Unit 2 – Chemistry of Air and Soil Pollution, Atmospheric Chemistry: Structure and composition of atmosphere.. Chemical reactions in troposphere and stratosphere (ozone chemistry, photochemical smog), Gaseous pollutant chemistry: SO₂, NO_x, CO, VOCs, ozone., Soil Chemistry: Soil composition, cation exchange capacity (CEC), pH buffering., Interaction of pollutants with soil minerals and organic matter, Heavy metals in soil: chemical behavior, mobility, bioavailability, Pollutant Transformation: Oxidation-reduction, photolysis, hydrolysis, biodegradation chemistry in environment.

Unit 3 – Fundamentals of Environmental Microbiology Microorganisms in Environment: Bacteria, fungi, protozoa, algae, viruses – structure, morphology, and classification., Microbial Nutrition & Growth: Growth phases, generation time, environmental factors influencing growth, Enzymes & Metabolism: Role of enzymes in environmental processes, aerobic and anaerobic respiration, fermentation pathways, Microbial Interactions: Symbiosis, commensalism, competition, predation in environmental systems, Microorganisms in Biogeochemical Cycles: Role in nitrogen fixation, nitrification, denitrification, carbon and sulfur cycling.

Unit 4 – Applied Environmental Microbiology, Water and Wastewater Microbiology: Indicator organisms, coliform bacteria, pathogens in water, Microbiology of Treatment Systems: Activated sludge process, trickling filters, anaerobic digesters, Biofilms in treatment systems, Microbial Degradation of Pollutants: Petroleum hydrocarbons, pesticides, phenols, heavy metals transformation, Microbial Techniques in Environmental Monitoring: MPN, membrane filtration, PCR-based detection methods., Biosensors for environmental monitoring, Bioaerosols and Industrial Hygiene: Sources, health impacts, control methods.

Manoj K...





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Unit 5 – Analytical and Monitoring Techniques, Chemical Analysis of Environmental Samples: Sampling, preservation, and preparation for water, air, and soil analysis. Spectrophotometry, titrimetric methods, chromatography (GC, HPLC), atomic absorption spectroscopy (AAS), ICP-MS, Microbiological Analysis, Culture-based methods, microscopy, staining techniques, Rapid detection methods for pathogens. Case Studies: Chemical contamination events and remediation (India & global), Outbreaks related to microbial contamination in water supply. Recent Advances: Metagenomics in environmental microbiology, Emerging contaminants and their detection, Nanotechnology-based sensors for environmental monitoring.

Outcomes

- Gain comprehensive understanding of chemical and microbiological processes in environmental systems.
- Develop skills for chemical and microbiological analysis of environmental samples.
- Interpret pollutant behavior and transformations in air, water, and soil.
- Apply microbiological knowledge in wastewater treatment, pollution control, and environmental monitoring.

Reference Books

1. Sawyer, C.N., McCarty, P.L., Parkin, G.F. – *Chemistry for Environmental Engineering and Science*
2. Manahan, S.E. – *Environmental Chemistry*
3. Pelczar, M.J., Chan, E.C.S., Krieg, N.R. – *Microbiology*
4. Tortora, G.J., Funke, B.R., Case, C.L. – *Microbiology: An Introduction*
5. Madigan, M.T., Bender, K.S., Buckley, D.H. – *Brock Biology of Microorganisms*
6. APHA, AWWA, WEF – *Standard Methods for the Examination of Water and Wastewater*

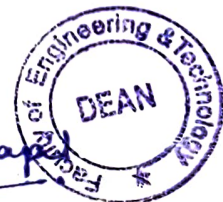
M.Tech

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Subharti Institute of Technology and Engineering

Swami Vivekanand Subharti University, Meerut

(Approved by AICTE)

Subhartipuram, NH-58 Delhi-Haridwar Bypass Road, Meerut-250005 (U.P.)

Ph.: 0121-2439157, Ext. 2222, 2221, Fax: 0121-2439108

E-mail: principal.site@gmail.com, principal.engg@gmail.com, Website: www.subharti.org



Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject : WATER AND SEWAGE TREATMENT

CODE: EEDE-219

Objective:

To provide advanced knowledge on the principles, design, and operation of water and sewage treatment systems, covering both conventional and modern approaches. The course will integrate theoretical and practical perspectives to ensure sustainable and efficient treatment for environmental protection and public health.

Unit 1: Water Quality and Standards, Sources and characteristics of water, Physical, chemical, and biological parameters of water quality, Drinking water standards: BIS, WHO, and CPCB norms, Overview of water treatment systems in India, Water demand, intake structures, and pumping arrangements, Coagulation and flocculation: principles, mechanisms, types of coagulants, flash mixing, flocculator design.

Unit 2: Conventional Water Treatment Processes. Sedimentation: types, theory, settling velocity, design of sedimentation tanks, tube settlers, Filtration: types (slow sand, rapid sand, pressure filters), filter media, under-drain systems, design criteria, filter operation, and cleaning, Disinfection: principles, chlorination chemistry, contact tanks, ozone, UV, advanced oxidation processes, Softening: lime-soda process, ion exchange, nanofiltration.

Unit 3: Sewage Characteristics and Primary Treatment, Sources and classification of sewage, Physical, chemical, and biological characteristics; BOD, COD, TSS, nutrients, Sewage quantity estimation and flow variations, Screening, grit removal: types of grit chambers, design criteria, Primary sedimentation tanks: design, sludge characteristics, and disposal.

Unit 4: Secondary and Tertiary Sewage Treatment, Microbiology of sewage treatment: microorganisms in biological treatment, microbial growth kinetics, activated sludge process (ASP) and modifications (extended aeration, oxidation ditch, SBR, MBR), Trickling filters: principles, design, operational issues, Anaerobic processes: UASB, anaerobic digesters, septic tanks, biogas recovery, Tertiary treatment: nutrient removal (N & P), disinfection, filtration, adsorption, membranes, reverse osmosis, advanced oxidation.

Unit 5: Sludge Management and Emerging Technologies, Sludge thickening, conditioning, digestion, dewatering, drying, and disposal, Biosolids reuse in agriculture, Energy recovery from sludge, Recent trends: constructed wetlands, hybrid systems, zero liquid discharge (ZLD), decentralized wastewater treatment systems (DEWATS), Smart water treatment technologies: IoT-based monitoring, AI applications, Case studies of modern STPs and WTPs in India.

Outcomes:

After completing this course, students will be able to:

1. Analyze water and wastewater quality for treatment requirements.
2. Design and evaluate treatment units for water and sewage.
3. Integrate conventional and advanced treatment processes for sustainable water management.
4. Apply environmental engineering principles to optimize operational efficiency.
5. Assess and incorporate emerging technologies into treatment plant design.
6. Develop solutions for sludge reuse, energy recovery, and resource optimization.

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Reference Books:

1. Metcalf & Eddy, *Wastewater Engineering: Treatment and Resource Recovery*, McGraw-Hill.
2. Peavy, H.S., Rowe, D.R., Tchobanoglous, G., *Environmental Engineering*, McGraw-Hill.
3. Droste, R.L., *Theory and Practice of Water and Wastewater Treatment*, Wiley.
4. Davis, M.L., Cornwell, D.A., *Introduction to Environmental Engineering*, McGraw-Hill.
5. Fair, G.M., Geyer, J.C., Okun, D.A., *Water and Wastewater Engineering*, Wiley.
6. Hammer, M.J., Hammer Jr., M.J., *Water and Wastewater Technology*, Prentice Hall.
7. AWWA, *Water Treatment Plant Design*, American Water Works Association.
8. Spellman, F.R., *Handbook of Water and Wastewater Treatment Plant Operations*, CRC Press.
9. CPHEEO Manual on Water Supply and Treatment, Ministry of Housing & Urban Affairs, Govt. of India.
10. CPHEEO Manual on Sewerage and Sewage Treatment, Ministry of Housing & Urban Affairs, Govt. of India.

M. Tech (EEN)

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
Course: M.Tech (Environmental Engineering & Management)

Subject: ENERGY & CLIMATE CHANGE

CODE: EEDE-212

Course Objectives

- To understand the fundamentals of energy systems, including energy sources, consumption patterns, and their environmental impacts.
- To analyze the scientific basis of climate change, its causes, consequences, and the role of energy production and use in global warming.
- To explore sustainable energy solutions and climate mitigation strategies, promoting informed decision-making for a low-carbon and resilient future.

Unit 1 – Fundamentals of Energy and Climate Science -Climate System Basics, Composition and structure of atmosphere, Energy balance of the Earth, Greenhouse effect: natural vs enhanced, Climate feedback mechanisms, Climate Change Science, Historical climate variations & paleoclimate evidence, Anthropogenic vs natural drivers of climate change, IPCC climate scenarios (RCPs & SSPs), Energy–Climate Nexus, Link between energy use and GHG emissions, Carbon intensity of different energy sources, Assessment Tools, Introduction to life cycle assessment (LCA) for energy systems, Carbon footprint estimation methods

Unit 2 – Renewable and Low-Carbon Energy Technologies, Solar Energy, Photovoltaic systems: design, efficiency, and applications, Solar thermal power systems, Wind Energy, Aerodynamics of wind turbines, Grid integration and variability issues, Bioenergy, Biomass conversion technologies: combustion, gasification, anaerobic digestion, Sustainability of biofuels, Hydropower, Small-scale vs large-scale hydropower, Environmental and social impacts Emerging Low-Carbon Tech, Hydrogen production & storage, Nuclear energy as low-carbon source: pros and cons, Geothermal energy systems

Unit 3 – Fossil Fuel Technologies and Carbon Management, Fossil Fuel Energy Systems, Coal, oil, and natural gas utilization, Environmental impacts: air pollution, water use, and mining footprint, Carbon Capture, Utilization & Storage (CCUS), Post-combustion, pre-combustion, and oxyfuel combustion technologies, Geological storage and mineralization, CO₂ utilization pathways (EOR, chemicals, building materials), Energy Efficiency in Fossil Systems, Combined heat and power (CHP), Efficiency retrofits for power plants, Transition Strategies, Phasing down coal, Gas as a transition fuel – debates and risks

Unit 4 – Climate Change Mitigation, Adaptation, and Policy, Mitigation Approaches, Renewable energy integration strategies, Demand-side management & energy efficiency measures, Decarbonizing industrial processes, Adaptation Strategies, Resilient infrastructure design, Climate-proofing water, energy, and food systems, Climate Economics, Social cost of carbon, Emissions trading schemes and carbon taxes, Global & National Frameworks, UNFCCC, Paris Agreement, Kyoto Protocol, India's National Action Plan on Climate Change (NAPCC) & State Plans, Sustainable Development Goals (SDG 7, 13), Monitoring & Verification, MRV (Measurement, Reporting, Verification) protocols for emissions

Unit 5 – Tools, Modelling, and Case Studies, Climate & Energy Modelling, Integrated Assessment Models (IAMs), Energy system models: MARKAL, TIMES, LEAP, GIS & Remote Sensing, Climate impact mapping, Renewable energy site selection, Case Studies-Renewable energy success stories (India & global), Climate adaptation projects in vulnerable regions, Corporate net-zero transition roadmaps, Research and Innovation Trends, Energy storage breakthroughs, Smart grids & digitalization for energy efficiency, Carbon-negative technologies

Manoj Kapri





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Outcomes

Developments of knowledge in the specific field of practice

To understand Environmental laws, different regulations policies and/or Executive orders related to Physical, Chemical, and Biological, Cultural.

To understand the interpretation of existing environmental conditions It provides a basis for interpreting the anticipated impact of the Project.

Reference Books:

1. Larry W. Canter: Environmental Impact Assessment
2. Glasson T: Environmental Impact Assessment
3. Petter Morris: Environmental Impact Assessment
4. Eceleston, C.H.: Environmental Impact Assessment
5. Paras Dewan: Environmental Administration Law & Judicial Attitude

M.Tech (EEM)

Manoj Kapil





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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering

Course: M.Tech (Environmental Engineering & Management)

Subject: : INDUSTRIAL EMISSION CONTROL SYSTEMS

CODE: EEDE-217

Course Objectives:

- To understand the sources, types, and characteristics of industrial emissions and their impacts on air quality, environment, and human health.
- To study the principles, design, and operation of emission control technologies, including particulate removal, gas treatment, and advanced pollution control systems.
- To develop the ability to evaluate, select, and apply appropriate emission control strategies to ensure regulatory compliance and promote cleaner industrial practices.

Unit 1 – Fundamentals of Industrial Air Pollution and Emissions, Sources of Industrial Emissions, Stationary sources: boilers, furnaces, incinerators, process vents, Mobile sources: transportation-related emissions from industries, Types of Pollutants, Particulate matter (PM_{10} , $PM_{2.5}$), Gaseous pollutants (SO_2 , NO_x , CO , VOCs, H_2S , NH_3), Hazardous air pollutants (HAPs), Odorous emissions, Emission Characteristics, Particle size distribution and settling velocity, Stack gas composition and temperature, Air Quality Standards and Regulations, National Ambient Air Quality Standards (NAAQS – India), WHO air quality guidelines, Industry-specific emission standards (CPCB/State PCB norms), Emission Measurement & Monitoring, Sampling techniques – isokinetic sampling, gravimetric method, Continuous Emission Monitoring Systems (CEMS)

Unit 2 – Particulate Matter Control Technologies-Gravity Settling Chambers, Principles, design considerations, efficiency calculation, Cyclone Separators, Centrifugal separation mechanism, efficiency factors, design equations, Fabric Filters (Baghouses), Filtration theory, types of filter media, cleaning mechanisms, Pressure drop considerations and maintenance, Electrostatic Precipitators (ESP), Electrostatic charging, migration velocity, design parameters, Wet vs dry ESPs, Scrubbers for Particulates, Spray towers, venturi scrubbers, packed bed scrubbers, Collection efficiency for fine particles

Unit 3 – Gaseous Emission Control Technologies, Absorption Processes, Packed and plate towers, Gas-liquid equilibrium, selection of absorbents, Adsorption Processes, Activated carbon, silica gel, zeolites, Breakthrough curves and regeneration techniques, Combustion & Thermal Oxidation, Direct flame, recuperative and regenerative oxidizers, Catalytic oxidation systems, Selective Catalytic and Non-Catalytic Reduction (SCR & SNCR), NO_x control in power plants and industrial boilers, Biofiltration & Biotrickling Filters, Microbial degradation of VOCs and odorous gases, Specialized Treatment, Control of mercury, acid gases, and greenhouse gases from industries

Unit 4 – Design, Integration, and Regulatory Compliance, Integrated Control Systems, Multi-pollutant control strategies, Hybrid systems (e.g., ESP + fabric filter, scrubber + adsorption), Design Optimization, Energy consumption vs removal efficiency, Retrofit and upgrade strategies for existing plants, Regulatory Compliance & Policy, Environmental Protection Act (India) – air emission clauses, Emission permits and reporting, Global protocols for air emission control (e.g., Gothenburg Protocol), Economic Analysis, Cost-benefit analysis of control systems, Life cycle costing, Best Available Techniques (BAT), CPCB/USEPA guidelines for industry sectors (cement, steel, power, chemical)

Unit 5 – Modelling, Monitoring, and Case Studies, Air Pollution Modelling, Gaussian plume dispersion model for industrial stacks, CALPUFF, AERMOD basics for industrial emission prediction, Emission Inventory Development, Data collection, categorization, and quantification methods, GIS & Remote Sensing in Air Pollution, Spatial analysis of industrial hotspots, Satellite-based pollution monitoring, Case Studies, Successful industrial emission reduction projects (India & global), Retrofitting coal-based industries for NO_x and SO_2 control, Cleaner production initiatives in manufacturing, Recent Trends & Innovations, Low-emission burners, Artificial intelligence in emission control system optimization, Carbon-negative and zero-emission industrial parks

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Outcomes

- Development of specialized knowledge in industrial air pollution control systems.
- Ability to interpret, design, and integrate emission control equipment in industrial applications.
- Understanding of environmental laws, regulations, and policies governing industrial emissions.
- Capability to assess existing industrial emission scenarios and propose mitigation strategies based on scientific and engineering principles.

Reference Books

1. David L. Russell – *Practical Wastewater and Air Pollution Control for the Plant Engineer*
2. Lawrence K. Wang, Norman C. Pereira, Yung-Tse Hung – *Air Pollution Control Engineering*
3. C. David Cooper, F.C. Alley – *Air Pollution Control: A Design Approach*
4. P. Nag – *Power Plant Engineering* (for combustion & flue gas treatment)
5. Howard D. Hesketh – *Air Pollution Control: Conventional and Emerging Technologies*
6. CPCB & USEPA Guidelines for Industrial Emission Control

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M.Tech (EEM)

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
Course: M.Tech (Environmental Engineering & Management)

Subject: Air Sampling & Testing Lab

Code: EEPC-251

Objective: laboratory is to determine the quality of air characteristics. The laboratory course will help the students to understand the concepts learned in the course.

1. Estimation of SPM (Suspended Particulate Matter)
2. Estimation of Sulphur dioxide
3. Estimation of oxides of nitrogen
4. Respirable particulate matters (PM_{10} and $PM_{2.5}$)
5. Estimation of Ozone
6. Estimation of Carbon mono-oxide
7. Estimation of hydrocarbons

Outcomes:

*Students have been taught the lab experiments as per syllabus.
Practical Knowledge of field*

Reference books:

1. Air Pollution Control by Johnson
2. Dynamics of Environmental Bio-processes by J.B. Snape and I. J. Dunn

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Ph.: 0121-2439157, Ext. 2222, 2221, Fax: 0121-2439108
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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
Course: M.Tech (Environmental Engineering & Management)

Subject: ENVIRONMENTAL REMOTE SENSING & GIS

Code: EEDE-213

Objective: Provide comprehensive instruction in the underlying concepts and principles of geographic information system (GIS) technology and its application to the design and analysis of civil and environmental engineering systems.

Unit-I: Remote Sensing: Basic concepts, Multi-Concepts in Remote Sensing, Advantages of Remote Sensing data, Applications of Remote Sensing.

Unit--II: Remote Sensing Platforms & Sensors, Remote sensing data products, referencing scheme, Digital data Format and characteristics, High Resolution Images, Image Processing Software.

Unit--III: Geometric & Radiometric corrections, Visual Image Interpretation Methods, Digital Image Enhancement, Digital Image Classification Methods, Accuracy Assessment.

Unit-IV: Geographical Information System; basic concepts of GIS, Digital representation of geographic data, Digitization of features, Database creation, Raster and Vector based GIS data, Overlay analysis, Buffering, Query, Spatial analysis- 3-D Analysis, Introduction of GIS software, Applications of GIS, National Map policy, National Spatial Data Infrastructure in India. Course

Outcomes:

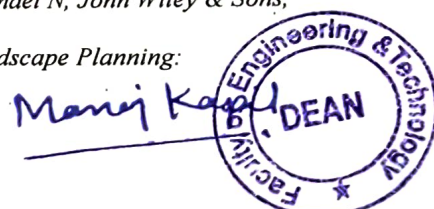
On completion of the course students will be able to:

- 1: Analyze the basic components of GIS.
- 2: Classify the maps, coordinate systems and projections.
- 3: Process spatial and attribute data and prepare thematic maps.

Reference Books:

1. Remote Sensing & DIP: by Lillesand & Keifer, John Wiley & Sons, Inc.
2. Principles of Geographical Information Systems, by Burrough, P. A. / Burrough, P. A., Oxford University Press. Reference Books: 1. Principles of Remote Sensing: by Curran, P. J. 2. Introduction of Digital Image Processing: by J. R. Jhonson, John Wiley & Sons, Inc.
3. Fundamentals of Geographical Information System, by DeMers, Michael N, John Wiley & Sons, Inc.
4. The GIS Book, 5th Edition, by Korte, George, Thomson Learning Landscape Planning: Environmental Applications, March, W. M., Wiley Sons, New York

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Department of Environmental Engineering
**Syllabus of M.Tech Environmental
Engineering and Management (EEM)**

THIRD SEMESTER

M.Tech

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Subharti Institute of Technology and Engineering

Swami Vivekanand Subharti University, Meerut

(Approved by AICTE)

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
M.Tech (Environmental Engineering & Management)

Subject: SEMINAR-I/PROJECT

Code: EEPC – 353

Objective:

Environmental Engineering Dissertations: (Core Course) Research Project and Dissertation specifically designed to give the student practical experience in technologies and principles appropriate to developing a Environmental technologies. Students under the supervision of Faculty Advisor, and with the due permission from the Chairperson / Coordinator will undertake a research based project for a duration of one full semester (four months) at Subharti University/ associated academic institution/ industrial partner/ any other industry /research organization outside Subharti University practicing Environmental technologies. A thesis written for this project will be evaluated by an expert followed by viva-voce.

1. The outline of the report should be as per the following-

- a. Introduction
- b. Review of Literature
- c. Materials and Methods
- d. Results and Discussion
- e. Conclusion and Summary
- f. References

Outcomes:

1. *Develop in-depth understanding of advanced environmental engineering concepts and technologies.*
2. *Apply theoretical and practical knowledge to solve real-life environmental problems.*
3. *Gain research experience through independent investigation and experimentation.*
4. *Analyze, interpret, and present technical data scientifically and systematically.*
5. *Enhance skills in literature review, research methodology, and technical writing.*
6. *Develop innovative and sustainable solutions related to environmental technologies.*
7. *Improve professional communication and presentation skills through seminar and viva-voce.*

Manoj K. Singh
DEAN
Faculty of Engineering & Technology



Subharti Institute of Technology and Engineering
Swami Vivekanand Subharti University, Meerut
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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
M.Tech (Environmental Engineering & Management)

Subject: Industry Internship/Live Case Study

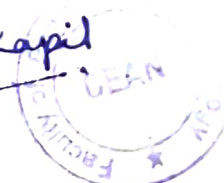
Code: EEIT- 354

Objective: It is optional online or offline Subharti University/ associated academic institution/ industrial partner/ any other industry /research organization outside Subharti University practicing Environmental technologies. A thesis written for this project will be evaluated by an expert followed by viva-voce.

Outcomes:

1. After completion of the Industry Internship / Live Case Study, the students will be able to:
2. Gain practical exposure to real industrial and environmental engineering practices.
3. Apply theoretical knowledge to solve industry-oriented environmental problems.
4. Understand the functioning of environmental technologies used in industries and research organizations.
5. Develop technical, analytical, and problem-solving skills through hands-on learning.
6. Enhance professional communication, teamwork, and project management abilities.
7. Acquire knowledge about industrial safety, sustainability practices, and environmental compliance.
8. Prepare and present a technical thesis/report based on internship or case study work.
9. Improve research aptitude and capability to conduct independent investigations.
10. Strengthen interaction with industries, research organizations, and academic institutions.
11. Develop confidence for professional careers, higher studies, and research in environmental engineering and sustainability sectors.

Manoj Kapil





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Department of Environmental Engineering
Syllabus of M.Tech Environmental
Engineering and Management (EEM)
FOURTH SEMESTER

M.Tech

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Swami Vivekanand Subharti University, Meerut
Subharti Institute of Technology and Engineering (SITE)
Department of Environmental Engineering
M.Tech (Environmental Engineering & Management)

Subject: DISSERTATION (Project & Execution Thesis)

Code: EEDE – 454

Objective:

Environmental Engineering Dissertations: (Core Course) Research Project and Dissertation specifically designed to give the student practical experience in technologies and principles appropriate to developing a Environmental technologies. Students under the supervision of Faculty Advisor, and with the due permission from the Chairperson / Coordinator will undertake a research based project for a duration of one full semester (four months) at Subharti University/ associated academic institution/ industrial partner/ any other industry/research organization outside Subharti University practicing Environmental technologies. A thesis written for this project will be evaluated by an expert followed by viva-voce.

The outline of the report should be as per the following-

- g. Introduction
- h. Review of Literature
- i. Materials and Methods
- j. Results and Discussion
- k. Conclusion and Summary
- l. References

Outcomes:

1. Develop in-depth understanding of advanced environmental engineering concepts and technologies.
2. Apply theoretical and practical knowledge to solve real-life environmental problems.
3. Gain research experience through independent investigation and experimentation.
4. Analyze, interpret, and present technical data scientifically and systematically.
5. Enhance skills in literature review, research methodology, and technical writing.
6. Develop innovative and sustainable solutions related to environmental technologies.
7. Improve professional communication and presentation skills through seminar and viva-voce.

Manoj Kapil



SWAMI VIVEKANAND SUBHARTI UNIVERSITY,
MEERUT



FACULTY OF ENGINEERING & TECHONOLGY

ORDINANCE No. V-42 (B9)

**RELATING TO COURSE CURRICULUM & SYLLABUS
OF PG PROGRAM**

MASTER OF TECHNOLOGY (M.Tech.) EEM

(Effective from the Session – 2025-26)

Apporved by the Academic Council of the Meeting held on 06 May 2025

Apporved by the Executive Council of the Meeting held on 28 June 2025

(A. Mukesh Reddy)



Kapil

(Dr. Shweta Bhardwaj)

(Mayank Kishor Singh)

SWAMI VIVEKANAND SUBHARTI UNIVERSITY,
MEERUT



FACULTY OF ENGINEERING & TECHNOLOGY

ORDINANCE No. V-42 (B9)

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OF PG PROGRAM**

MASTER OF TECHNOLOGY (M.Tech.) EEM

(Effective from the Session – 2025-26)

Approved by the Academic Council of the Meeting held on 06 May 2025

Approved by the Executive Council of the Meeting held on 28 June 2025

(A. Mukesh Rohilla)



Kapil

(Dr. Susha Bhardwaj)

(Mayank Kishor Singh)