

Post Graduate Certificate Programme
in
***Environmental Monitoring and Impact
Assessment***



**Centre for Rural and Entrepreneurship
Development**

**National Institute of Technical Teachers
Training and Research (NITTTR)**
Government of India, Ministry of Education
Chennai (Tamil Nadu). India.

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Preamble

Post Graduate Certificate in “Environmental Monitoring and Impact Assessment” is curated in a way that will describe the exhaustive baseline data collection, interpretation, report writing and framing environmental management plan. This will also fulfil all aspects for a professional aspiring to be an environmental impact assessment (EIA) coordinator (EC) and functional area expert (FAE). A complete understanding on the following functional areas will be covered;

1. Air pollution monitoring, prevention and control
2. Air quality modeling and meteorology
3. Water pollution monitoring, prevention and control
4. Ecology and biodiversity
5. Land use
6. Noise and vibration
7. Hydrology, ground water and conservation
8. Geology
9. Soil conservation
10. Risk assessment and hazard management
11. Solid and hazardous waste management
12. Socio-economics

Key Programme Details

- The Post Graduate Certificate Programme in Environmental Monitoring and Impact Assessment is a one-year course that will provide enrollers with the knowledge, skills, and competencies to become an EC and FAE.
- This course is a standalone of its kind in the area of environmental monitoring and laboratory/quality management systems.
- The course content aligns with most of the Sustainable Development Goals (SDGs) of the United Nations.

Reasons to consider this course

- Earn the Industry Ready PG certificate curated by National Institute of Technical Teachers Training and Research (NITTTR) a national institute of repute.
- Become a competent professional in EIA consultancy services and this programme will facilitate the basic training requirements for being a EC and FAE by statutory agencies.

Course Duration

- Contextually designed as an One year programme comprising TWO semesters

Delivery Method

- Medium: English.
- Venue: NITTTR, Chennai
- Mode: Hybrid

Class Timings

- 9 am to 1 pm and 2 pm to 6 pm
- No. of Weeks in a Month = 2 weeks (Only on Alternate Saturday)
- No. of Months = 12 Months
- 12 Months x 2 Weeks = 24 Weekends
- 1 Credit = 6 hrs. of Lectures
- 4 Credit = 24 hours
- Overall Credit = 30

Entry Requirements

Eligibility earmarked for this programme is 55% to 60% overall or a CGPA of 5.5 to 6, in any of the following fields but not limited to;

- **Technical Subjects:** Civil/Environmental/Chemical/Mechanical/Instrumentation/ Mining/Aeronautical /Electrical / Hydraulic/ Earth Resource/Agricultural/Fire/ Architecture/ Town Planning/ Urban Planning/Physical Planning/ Environmental Planning
- **Science Subjects:** Environmental Sciences/Environmental Studies/Industrial Pollution Control/Physics/Chemistry/Meteorology/Atmospheric Sciences/Public Health/Natural Resource Management/ Life Sciences/ Hydrology/Geo-hydrology/ Geoinformatics/ Remote Sensing/ Environment Management/Geo-Engineering/Earth Sciences/ Geography/ Geophysics/ Geology/Applied Geology/ Water Resource Management/ Acoustics/ Geophysics/Statistics/ Social Welfare/Sociology/Political Science/ Psychology/ Anthropology/ Economics/ Developmental Sciences/ Toxicology/Industrial Safety/Natural Science
- **Management Subjects:** Rural Development and Management/Rural Economics/ Economics Sociology/Demographic Studies/Rural Management

Other Details

In addition to the above, the following is required:

- Attendance is Mandatory.
- Commitment to physically attend the required laboratory sessions, filed work and assessments in NITTTR, Chennai.

Programme Fee

- ₹50,000/- + Applicable GST

Certification

- A minimum of 75% attendance is a prerequisite for the successful completion of the programme.
- On successful completion, PG Certificate will be awarded by NITTTR, Chennai.

Course of Study & Credits

Semester-I		
Course Number	Course Name	Credit
EMIA-01	Environmental Impact Assessment	3
EMIA-02	Pollution, Prevention and Control	3
EMIA-03	Ecology and Biodiversity	3
EMIA-04	Risk Assessment and Hazard Management	3
EMIA-05	Environmental Engineering Laboratory	3
Semester-II		
EMIA-06	Modeling of Environmental Systems	3
EMIA-07	Geo-techniques in Environmental Management	3
EMIA-08	Solid Waste Management and Marine Outfalls	3
EMIA-09	Environmental Governance	3
EMIA-10	Dissertation Work	3
Total Credits		30

Evaluation Scheme

Semester-I				
Course Number	Course Name	Internal	External	Total
EMIA-01	Environmental Impact Assessment	20	80	100
EMIA-02	Pollution, Prevention and Control	20	80	100
EMIA-03	Ecology and Biodiversity	20	80	100
EMIA-04	Risk Assessment and Hazard Management	20	80	100
EMIA-05	Environmental Engineering Laboratory	20	80	100

Semester-II				
Course Number	Course Name	Internal	External	Total
EMIA-06	Modeling of Environmental Systems	20	80	100
EMIA-07	Geo-techniques in Environmental Management	20	80	100
EMIA-08	Solid Waste Management and Marine Outfalls	20	80	100
EMIA-09	Environmental Governance	20	80	100
EMIA-10	Dissertation	20	80	100

Internal Marks (20 Marks)

- Seminar: 5 Marks
- Assignment: 5 Marks
- Attendance: 10 Marks

Key Learning Outcomes

On successful completion of this programme graduates should be able to:

- ✓ Demonstrate strong knowledge and understanding of the fundamental concepts in environmental monitoring and impact assessment.
- ✓ Apply knowledge of all technical and scientific aspects in the preparation of EIA report
- ✓ Ability to collect the baseline data, analyze and interpret the data.
- ✓ Design sustainable processes to meet the global challenge.
- ✓ Formulate a sound environmental management plan for the industrial sectors.

- ✓ Identify and map the environmental impacts in a global, economic, and societal context.
- ✓ Acquire knowledge on different functional areas in the preparation of EIA report.

Course Co-Ordinator

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EMIA-01: ENVIRONMENTAL IMPACT ASSESSMENT

Unit-I: Introduction

Development of Environmental Impact Assessment (EIA) – Legal and Regulatory Frameworks – Process – Sectoral issues and terms of reference – Public Participation – EIA Consultant Accreditation Over-exploitation – Equitable use for sustainable lifestyles – Sustainability

Unit-II: Environmental Monitoring and Impact Analysis

Baseline data collection – Expert systems in EIA – Impact prediction – Mathematical Modelling – Assessment of Impacts – Cumulative Impact Assessment

Unit-III: Documentation and Social Issues

Planning – Impact identification – Institutional arrangements – EIA documentation – Planning – Structuring of baseline data and interpretation – Conservation – Watershed management – Resettlement and rehabilitation – Climate change – Wasteland reclamation – Bottlenecks in enforcing legislations – public awareness.

Unit-IV: Environmental Management Plan

EIA Report preparation – Implementation and review – Mitigation and Rehabilitation Plans – Policy and Guidelines – Monitoring Programmes – Environmental Audit – Quality aspects of EIA

Unit-V: Environmental Risk Assessment and Management

Environmental risk assessment – Hazard identification – Exposure Assessment – Environmental Risk Assessment Tools – Risk Characterization – Emergency Preparedness – Risk management – Causes, effects and control measures of pollution – Measures of urban and industrial wastes – Disaster management: plan – Emergency preparedness

References:

1. Canter, L. W., & Wood, C. (1996). Environmental impact assessment, McGraw Hill, New York.
2. Cutter, S.L. (1994). Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi. ISBN- 0137538561.

3. Rao, K., Steven, B., & Pitblado, R. (1996). Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York.
4. Lawrence, D. P. (2013). Impact assessment: practical solutions to recurrent problems and contemporary challenges. John Wiley & Sons. ISBN 9781118097373.
5. Bharucha, E. (2002). The Biodiversity of India (Vol. 1). Mapin Publishing Pvt Ltd.
6. Masters, G. M. (1998). Introduction to environmental engineering and science. Second Edition, Pearson Education Pvt., Ltd. ISBN 0-13-889064-1
7. Miller Jr, T. G. (2022). Environmental Sciences. Wadsworth Publishing Co.(TB).

EMIA-02: POLLUTION PREVENTION AND CONTROL

Unit-I: Pollution

Sources and classification of pollutants - Effects of pollutants on life systems – Climate Change – Inventories – Sampling from environmental matrices

Unit-II: Modelling of pollutant transfer

Dispersion – Meteorology – Atmospheric stability – Inversion –Stack Plume Patterns – Modelling Techniques – Dilution – Hydrodynamics – Bathymetry

Unit-III: Control of Pollutants

Selection of Control Equipment – Design and performance – Operational Considerations – Process Control and Monitoring – Costing – Case studies

Unit-IV: Environmental Compliance

Continuous environmental monitoring – In-situ & Ex-situ monitoring – Compliances with Norms – Regulations

Unit-V: Environmental Quality Management

Measurement – Standards –Control and Preventive Measures – IS methods – CAPA – LCA

REFERENCES

1. Peirce, J. J., Vesilind, P. A., & Weiner, R. (1998). Environmental pollution and control. 4th Edition Butterworth-Heinemann. ISBN-13: 978-0-7506-9899-3.

2. Rao, C. S. (2006). Environmental pollution control engineering. Revised Second Edition, New Age International. ISBN- 81-224-1835-X

EMIA-03: ECOLOGY AND BIODIVERSITY

Unit-I: Ecotechnology

Ecological Engineering – Relevance to industrialization – Ecological Communities – Energy and Material Cycling – Ecological Productivity

Unit-II: Environmental Interactions

Ecotechnology – Principles and components of systems – Modelling – Structural and functional interactions – Anthropogenic Interventions

Unit-III: Ecological Sustainability

Self-organizing processes – Microcosms – Energy – Ecotechniques and catastrophic events – Carrying Capacity – Sustainable loadings

Unit-IV: Ecological Engineering

Constructed wetlands – Hydroponics – Aquaponics – Vermicomposting – Bioprospecting

Unit-V: Integrated ecology and biodiversity

Biogeochemical cycles – Biodiversity Management – Ecological unveiling for value additives

References

1. Ignaci Muthu S, 'Ecology and Environment' Eastern Book Corporation, 2007.
2. Krebs, C. J. (2001). Ecology the experimental analysis of distribution and abundance 5th ed. Benjamin Cumming, San Francisco, CA
3. Jorgensen, S. E., & Mitsch, W. J. (Eds.). (1989). Ecological Engineering: An Introduction to Ecotechnology. John Wiley & Sons.

EMIA-04: RISK ASSESSMENT AND HAZARD MANAGEMENT

Unit-I: Risk Analysis

Quantitative risk assessment – Safety, Risk and hazard – Risk Analysis & Assessment – Evaluation – Control

Unit-II: Hazard Identification

Identification – Consequence Analysis – Probabilistic Hazard Assessment – Workplace Hazards – Ergonomics

Unit-III: Disasters and Management

Risk contours for failures – Disaster Management Plan – Emergency Planning – Onsite and Offsite Planning – Risk Management – Case studies

Unit-IV: Risk modelling

Accidental Release Modelling – Dispersion – BLEVE – Case studies – Domino Effect – Safety Measures

Unit-V: Toolkits

Governmental Policies – HAZOP – HIRA – Software Packages for Risk Management

References

1. Crowl, D. A., & Louvar, J. F. (2001). Chemical process safety: fundamentals with applications. Second Edition, Pearson Education. ISBN-0-13-018176-5
2. Houston, H. B. (1997). Process safety analysis. Gulf publishing company.
3. Khan, F. I., & Abbasi, S. A. (1999). Risk assessment of chemical process industries; Emerging technologies. Discovery publishing house, New Delhi

EMIA-05: ENVIRONMENTAL ENGINEERING LABORATORY

Parameters

- PM₁₀, PM_{2.5}, SO₂, NO_x, CO, Ozone, Ammonia, Particulate metals (As, Ni, Pb), Benzene, Benzo (a)pyrene, Asbestos.
- Temperature, depth, turbidity, density of water, total suspended solids, salinity, pH, dissolved oxygen, biochemical oxygen demand (BOD), NH₄-N, NO₂-N, NO₃-N, Total - N, PO₄-P, Total -P, and Silicate.
- Chlorophyll-a, phaeophytin, heavy metal contents
- Numerical and biomass density per unit area, identification of species and species diversity of benthic fauna, phytoplankton and zooplankton
- Microbiological analysis Total viable count, Total Coliforms, Faecal Coliform

References

1. APHA, 2017. Standard Methods for the Examination of Water and Wastewater. American Public Health Association/American Water Works Association/Water Environment Federation, Washington DC, USA.

EMIA-06: MODELLING OF ENVIRONMENTAL SYSTEMS

Unit-I: Ecological Modelling

Ecology and Ecological Modelling – Population Dynamics – Lotka-Volterra Model – Primary Production – Dynamic Stability analysis

Unit-II: Reactor Configurations

Continuous – Flow Reactor Modelling – Parametric Calibrations – Growth Kinetics – Inhibitory Growth Kinetics

Unit-III: Hydrodynamics

Self-purification of Rivers – Streeter-Phelps Model – Nutrient Dynamics – Dissolved Oxygen Dynamics – Oxygen Saturation – Dispersion – Bathymetry

Unit-IV: Environmental Biotechnology

Microbial Dynamics – Microbial Energetics – Microbial Interactions – Activated Sludge – Aerobic and Anaerobic Digestion – Operational controls

Unit-V: Chemo-metric tools

Design of Experiments – Fuzzy System Modelling – Cluster Analysis – Principal Component Analysis – Artificial Neural Network

References

1. Stern, A. C. (2015). Air Pollution V1: Air Pollutants, Their Transformation and Transport (Vol. 1). Third Edition, Academic Press. ISBN- 0-12-666601-6.
2. Chapra, S. C. (2008). Surface water-quality modeling. McGraw-Hill. ISBN- 1-57766-605-4.
3. Deaton, M., & Winebrake, J. J. (1999). Dynamic modeling of environmental systems. Springer Science & Business Media.
4. Orhon, D., & Artan, N. (1994). Modelling of the activated sludge systems. Technomic Publ. Co., Lancaster.
5. Schnoor, J. L. (1996). Environmental modeling: fate and transport of pollutants in water, air, and soil. John Wiley and Sons. ISBN- 9780471124368.

EMIA-07: GEO-TECHNIQUES IN ENVIRONMENTAL MANAGEMENT

Unit-I: Overview of Remote Sensing

Land Use –Land Cover – Spectral Signatures – Spectral Response Pattern – Canopy – Ground-truthing –Aerial photographs – Multispectral Remote Sensing – Sensors

Unit-II: Geographical Information System

Concepts – Spatial and non-spatial data – Data Structures – Data Analysis – Database Management – Case studies

Unit-III: Hydrology

Hydro-metrology – Hydrologic Cycle – Aquifers – Aeration and Saturation – Groundwater Hydraulics

Unit-IV: Data Processing

Characteristics of Remote Sensing data – Photogrammetry – Satellite data analysis – Visual Image interpretation – Digital image processing – Image Rectification – Merging – RS and GIS Integration

Unit-V: Environmental Applications

Environmental Monitoring – Demarcation of Coastal Zones – Conservation of Resources – Sustainable Land Use

References

1. Burrough, P. A., McDonnell, R. A., & Lloyd, C. D. (2015). Principles of geographical information systems. Oxford University Press, USA. ISBN- 978-0-19-874284-5.
2. Konecny, G. (2014). Geoinformation: remote sensing, photogrammetry and geographic information systems. Second Edition cRc Press. ISBN-13 : 978-1-4200-6856-6.
3. Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). Remote sensing and image interpretation. Seventh Edition, John Wiley & Sons. ISBN- 978-1-118-34328-9.
4. Lintz, J. (1998). Simonet. Remote sensing of Environment. Addison Wesley Publishing Company, New Jersey.
5. Henderson, F. M., & Lewis, A. J. (1998). Principles and applications of imaging radar. Manual of remote sensing: Volume 2. John Wiley and Sons.

EMIA-08: SOLID WASTE MANAGEMENT AND MARINE OUTFALLS

Unit-I: Collection and Segregation of Solid Waste

Solid Waste – Generation, Sources and Types – Municipal Solid Wastes – Hazardous Wastes – Biomedical Wastes – E-waste – Industrial Hazardous Wastes – Type of waste collection systems – Alternative techniques – Separation and Processing – Unit Operations – Recovery – Waste Valorization – Composting – Energy recovery – Incinerators – Landfill – Sanitary and Secured – Leachate Collection Systems – Landfill Remediation – Identification – Characteristics – Regulations – Waste Minimization – Waste-compatibility – Handling – Storage – Collection – Transport

Unit-II: Waste Treatment Technologies

Design and Operation – Thermal Treatment – Pyrolysis – Co-pyrolysis – Solidification – Encapsulation – Sampling – Characterization – TCLP – Leachate analysis – Toxicity Tests

Unit-III: Ocean Hydrodynamics

Seas and oceans – Continental area – Coastal zone– Physico-chemical properties – Marine Geology – Biotic components of marine ecosystems – Mudflats – Mangroves – Halophytes – Seaweeds – Wave Theory – Water conditions – Tidal Classification – Ocean Currents – Sediment Transport Coastal processes

Unit-IV: Marine Pollution Monitoring

Sources of Marine Pollution – Accidental Oil Spillages Dredging – Discharges and Effluent Standards – Marine Sampling and Characterization –Measurements – Echo Sounders – Current Meters – GPS – Sampling of Water and Sediments –Dispersion modelling – Buoy – Ocean Information Systems

Unit-V: Coastal Management

Pollution Control strategies – Selection of Discharge Points – Coastal Regulation Zone – Life Below Water – Life on Land

References

1. Laws, E. A. (2000). Aquatic pollution: an introductory text. Third Edition, John Wiley & Sons. ISBN- 0-471-34875-9.
2. Hofer, T. N. (2008). Marine pollution: new research. Nova Publishers. ISBN-978-1-60456-242-2.
3. Kennish, M. J. (2017). Practical handbook of estuarine and marine pollution. 1st Edition, CRC press. <https://doi.org/10.1201/9780203742488>. Ebook ISBN 9780203742488.
4. Central Public Health, & Environmental Engineering Organisation (India). (2000). Manual on municipal solid waste management. Central Public Health and Environmental Engineering Organisation, Ministry of Urban Development, Government of India.
5. LaGrega, M. D., Buckingham, P. L., & Evans, J. C. (2010). Hazardous waste management. Second Edition, Waveland Press. ISBN- 1-57766-693-3.

6. Tchobanoglous, G., Theisen, H., & Vigil, S. A. (1993). Integrated solid waste management: engineering principles and management issues. McGraw-Hill. ISBN-0070632375.
7. Vesilind, A., & Worrel, W. (2002). Reinhax, "Solid Waste Engineering", Thomson Asia Pte.

EMIA-09: ENVIRONMENTAL GOVERNANCE

Unit-I: Regulatory Frameworks

Overview of Major Environmental Issues – Environmental Laws – Hazard Assessment

Unit-II: Process Safety

Chemical Process Safety – Environmental Protection and Persistence – CSR Activities – SSR activities

Unit-III: Green Chemistry Principles

Green Chemistry – Quantitative Frameworks – Pollution Prevention – Unit Operations – Fugitive Emissions – Mitigation Tools

Unit-IV: Environmental Fate

Process Energy Integration – Biomagnification – Bioaccumulation – Biotransfer – Bioconcentration – Estimation of Environmental Fates

Unit-V: Environmental Costing and Sustainability

Environmental Costs – Liability Costs – Life Cycle Assessment – Sustainable development – Sustainable Development Goals – Stockholm Convention – Basel Convention – European Union

References

1. Allen, D. T., & Shonnard, D. R. (2001). Green engineering: environmentally conscious design of chemical processes. Pearson Education.
2. Doble, M., Rollins, K., & Kumar, A. (2010). Green chemistry and engineering. Academic Press. ISBN- 978-0-12-372532-5.