NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Green Skill Development Course

Course Aim:

Support the students of Botany, Zoology, Environmental Science, Geology and Geography to develop their skills in terms of maintaining the eco-friendly campus in an Organization and to progress India's youth into employable and/or self-employment, making use of the widespread network and experience with environmental protection and nature conservation.

Learning Objectives:

The students and staff members enable to

1. Develop green skilled workers having technical knowledge and commitment to sustainable development, which will help in the attainment of making India into greenish.
2. Exhibit the skills on establishment of green campus at Educational Institutions and Industrial sectors across the globe towards sustainable development goals and national biodiversity targets.
3. Understand the principles and importance of various audits in the context of the organization and risk assessment to Educational Institutions and Industries.
4. Study the concept on how to conduct 'Green campus audit', 'Environmental audit' and 'Hygiene/Water/Soil audits' at 360˚ view?.
5. Become a Lead Auditor and Entrepreneur in the field of Green Campus and Environment Management Audits to provide solution for environmental problems.

Course Outcomes:

1. Development of basic understanding on Environment Management System and overview of International Standards on ISO 14001:2015.
2. Understand the audits groundwork, checklist preparation, practical auditing and auditing techniques, Audit/Non-conformity report preparation and submission.
3. Expose for the expertise on wildlife conservation, nurseries, gardening etc. with Department of atmosphere and Environment and Forests of the Central Governments as well.
4. Study the methods of disposal, ways to reduce the carbon footprint and the importance of green campus and environment policy to solve the environmental problems
5. In what way the audit process supports the nation for the noble cause of environmental protection and nature conservation to enhance the quality of life to human beings.

Unit I: Introduction to green skill development [6 hours]

What are green skills?, Importance of Green Skill Development Programme, Financial or social constraints in green skill development, Green skilled workforce, Information, abilities, values and attitudes of green skills, Cleaner and greener production and service patterns, Green construction of buildings, Indian, Green building code, Indian Green Building Council, Biodiversity and its conservation,

Unit I: Introduction to plant and animal species [6 hours]

Introduction to plant and animal species, Plant and animal taxonomy, Flora and Fauna diversity of terrestrial, marine and coastal regions, Mammals, Birds, Grasshopper, Butterflies, Mosquitos Reptiles, Amphibians and Termites role in ecosystem, Plant breeding techniques, Nursery development, Types of gardening, Water Irrigation system, Use of Biofertilizers, Vermicompost, Organic manures, Aquarium development.

Unit II: Introduction and Importance of Green campus Audit [6 hours]

Introduction to green campus audit, Green campus audit procedures, Target areas of green auditing, Forest and planted Vegetation, Natural topography, Landscape design, Soil erosion control, Pedestrian Path, Rain harvesting system, Acoustic proof in Indoor and Outdoor Stadiums, Recommendations for greening the campus.

Unit III: Introduction and Importance of Environment Audit [6 hours]

Environmental Management System, Environment audit procedures and target areas of environment auditing, Benefits, phases and components of environmental audit, Environmental risk assessment, Public transport, Low emitting vehicles and control of car smokes and exhausts, Carbon footprint by measuring carbon dioxide and oxygen levels in the campus, Recycling of solid wastes and wastewaters, Plastics, E-wastes and Biomedical waste management audits.

Unit V: Case studies, Auditing Techniques and Audit Report Preparation [6 hours]

Case studies, Seminars, Assignment, Tutorials and Auditing exercises, Audited site visits and demonstrations, Audits groundwork, checklist preparation, Practical auditing and auditing techniques, Audit conformity and Non-conformity report preparation, Recommendations and suggestions after audit to the auditees.

Total Lectures / Demonstrations / Case studies / Audited site visits Hours [30 hours]

Text Books:

1. Gnanamangai, B.M., Murugananth, G. and Rajalakshmi, S. 2021. *A Manual on Environment Management Audits to Educational Institutions and Industrial Sectors*. Laser Park Publishing House, Coimbatore, Tamil Nadu, India.
2. Ponmurugan, P., Deepa, M.A. and Shreeram B. 2022. Green skill development. New Age International Publishing, New Delhi. (In Press).
3. Rajalakshmi, S., Kavitha, G. and Vinoth kumar, D. 2021. *Energy and Environment Management Audits*. AkiNik Publishing, New Delhi, India.

Reference Books:

1. Cardozo, N.H., da Silveira Barros, S.R., Quelhas, O.L.G., Filho, E.R.M. and Salles, W. 2019. Benchmarks analysis of the higher education institutions participants of the Green Metric World University Ranking. Springer, Universities and Sustainable Communities: Meeting the Goals of the Agenda 2030, World Sustainability Series.
2. IGBC, 2021. Indian Green Building Council. https://igbc.in/igbc/
3. Leal Filho, W., Muthu, N., Edwin, G. and Sima, M. 2015. *Implementing campus greening initiatives: approaches, methods and perspectives*. Springer, London, UK.
4. Pramanik, A.K. 2013. *Environmental Audit and Indian Scenario, Environmental Accounting and Reporting*. Deep and Deep Publications, New Delhi, India.
5. Roethlisberger, F.J. and Dickson, W.J. 2017. Hygiene *Management and its Implementation.* Harvard University Press. Cambridge, UK.
6. Thompson, D. 2018. *Tools for Environmental Management*. New Society Publishers, Gabriola Island, BC.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

AI Tools in Environmental Sustainability

Students should know about the fundaments and basic knowledge of Science, Engineering and Technology along with basic laboratory skills.

Course Objectives:

- Enable the students to understand the sources of innovation, opportunities and development of skills for entrepreneurship and start-ups.
- Study the concept and fundamentals on how are AI, ICT and IoT tools applied in promoting environment sustainable practices for a greener future?.
- Become a Lead Auditor, Consultant, Technical Expert and Entrepreneur in the field of Green, Energy and Environment Audits to provide solution for environmental problems using AI technologies.

Course Outcomes:

Students will be able to:

1. Understand the mind-set towards start-up companies by applying entrepreneurial skills and learning about ISO standards and IPR polies to develop business strategy.
2. Apply the knowledge of ICT, IoT and AI technologies to solve environment sustainability challenges in corporate industries at 360˚ view.
3. Comprehend the environment suitability audits groundwork, checklist preparation, and auditing techniques, audit/non-conformity report preparation and submission.
4. Study the methods of disposal, ways to reduce the wastes through carbon footprint, carbon trading and offsetting to solve the environmental problems.
5. In what way the environment sustainability process supports the nation for the noble cause of environmental protection and nature conservation to enhance the quality of life to human beings.

Topics to be covered

Unit No	Topics planned
1	**ENVIRONMENT SUSTAINABILITY, ISO AND IPR POLICIES:** Introduction to green, environment, energy, hygience, air, soil, water and waste management, Auditing techniques and implementation procedures, International Standards (ISO 14001:2015, 50001:2018 and 17020:2012), Intellectual Property Rights, Patents, Technology transfer.
2	**GREEN HOUSE GAS EMISSION AND INTERNATIONAL STANDARDS:** Greenhouse gas emissions, International and Local standards (ISO 14064-1:2018, ISO 14064-2:2019 and ISO 14064-3:2019), Carbon auditing: Definition, Process, Boundaries and Quantification, Carbon footprint measurements.
3	**AI TOOLS & TECHNOLOGIES IN ENVIRONMENT SUSTAINABILITY:** Introduction of Artificial Intelligence, AI in environment sustainability, AI in Water treatment, Waste management and Air quality monitoring.
4	**ICT AND IOT APPROACHES IN ENVIRONMENT SUSTAINABILITY:** AI-driven solutions for environment sustainable development goals, ICT tools for data collection and analysis, IoT, Cloud computing and Machine Learning techniques in environmental monitoring.
5	**ENTREPRENEURSHIP SKILLS:** Entrepreneurship, Bioentrepreneurship, Biobusiness, Large scale production of mushrooms, Biofertilizers, Vermicompost, Bakery, Confectionary and Dairy products for commercial exploitation.

Teaching Methodology:

Module I **:** On-Board & PPT slides

Module II **:** Assignments, Tutorials through Case studies, Group Discussions & Quiz

Module III **:** Industrial Visits & Field Trips

Module IV **:** Experimental Demo (CO_2, O_2, Noise, Light, Voltage, pH & TDS Meters)

Module V **:** Practicals (air, water and soil quality)

Text Books:

Course material to be prepared by Nature Science Foundation.

Reference Books:

Gnanamangai, B.M., Murugananth, G. and Rajalakshmi, S. 2021. *A Manual on Environment Management Audits to Educational Institutions and Industrial Sectors*. Laser Park Publishing House, Coimbatore, Tamil Nadu, India.

Fowdur, T.P., Rosunee, S., Ah King, R.F.T. and Jeetah, P. 2024. Artificial Intelligence, Engineering Systems and Sustainable Development: Driving the UN SDGs. Emerald Publishing Limited, Leeds, UK.

Gupta, R.K., Jain, A., Wang, J. and Pateriya, R.K. 2024 Reshaping Environmental Science Through Machine Learning and IoT. IGI Global, Hershey, US.

Ong, H.L., Doong, R., Naguib, R., Lim, C.P. and Nagar, A.K. 2022. Artificial Intelligence and Environmental Sustainability: Challenges and Solutions in the Era of Industry 4.0. Springer, Singapore.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Green Computing and Sustainable Development

COURSE OBJECTIVES:

To enable the postgraduate students to,

1. Understand the dimensions and goals of Green IT and Environment Sustainability.
2. Discuss the green networks and communications.
3. Analyze the steps involved in enterprise IT readiness.
4. Understand the concept of green and environment compliance.
5. Apply Green IT strategies and AI tools fundamentals.

COURSE OUTLINE:

UNIT I: **6 hrs**

Green IT: An Overview: Introduction - Environmental Concerns and Sustainable Development - Environmental Impacts of IT - OCED Green IT Framework – Green IT 1.0 and 2.0 - Holistic Approach to Greening IT: Greening Computer's Entire Life Cycle.

UNIT II: **6 hrs**

Green Devices and Hardware – Green Software – Sustainable Software Development – Software sustainability attributes - Software sustainability metrics - Sustainable Software Methodology – Green Data Centre and Storage – Green Networks and Communications.

UNIT III: 6 hrs

Enterprise Green IT Strategy – Sustainable Information Systems and Green Metrics - Development and Measuring G-Readiness Framework – Sustainable IT Services: Factors driving the development of Sustainable IT – SITS Sustainable IT Services – SITS Strategic framework.

UNIT IV: 6 hrs

Green Enterprises and Role of IT - Managing Green IT - Strategizing Green Initiatives – Implementation of Green IT – Information Assurance – Communication and Social Media – Regulating Green IT: Laws, Regulations and Protocols.

UNIT V: 6 hrs

Green Computing and Environmental Sustainability: Cloud computing and Energy Usage Model – Features of cloud enabling Cloud – Towards energy efficiency of Cloud computing – Role of AI in Environment Sustainablity – Green, Energy, Environment and Waste Management Audits.

17 Sustainable Development Goals:
(https://www.un.org/sustainabledevelopment/sustainable-development-goals/)

RECOMMENDED TEXT BOOKS:

1. San Murugesan, G. R. Gangadharan, "Harnessing Green IT: Principles and Practices", Wiley-IEEE Computer Society Pr, 2012.
2. Fowdur, T.P., Rosunee, S., Ah King, R.F.T. and Jeetah, P. 2024. Artificial Intelligence, Engineering Systems and Sustainable Development: Driving the UN SDGs. Emerald Publishing Limited, Leeds, UK.
3. Gnanamangai, B.M., Murugananth, G. and Rajalakshmi, S. 2021. *A Manual on Environment Management Audits to Educational Institutions and Industrial Sectors*. Laser Park Publishing House, Coimbatore, Tamil Nadu, India.

REFERENCE BOOKS:

1. John Lamb, "The Greening of IT", Pearson Education, 2009.
2. Jason Harris, "Green Computing and Green IT– Best Practices on Regulations &Industry", Lulu.com, 2008.
3. Woody Leonhard, Katherrine Murray, "Green Home Computing for Dummies", August 2009.
4. Ong, H.L., Doong, R., Naguib, R., Lim, C.P. and Nagar, A.K. 2022. Artificial Intelligence and Environmental Sustainability: Challenges and Solutions in the Era of Industry 4.0. Springer, Singapore.

JOURNALS:

1. IEEE Transactions on Green Communications and Networking - https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7892946
2. Energy & Environmental Science - https://pubs.rsc.org/en/journals/journalissues/ee#!recentarticles&adv
3. Journal of Photonics for Energy - https://www.spiedigitallibrary.org/journals/journal-of-photonics-for-energy
4. Energy and Buildings - https://www.sciencedirect.com/journal/energy-and-buildings
5. Journal of Smart Environments and Green Computing - https://www.oaepublish.com/jsegc

E-LEARNING RESOURCES:

1. https://www.greenit.net/greenit_training.html
2. https://training.linuxfoundation.org/training/green-software-for-practitioners-lfc131/
3. https://campaign.bcs.org/greenit
4. https://learn.greensoftware.foundation/
5. https://softwarecampus.de/en/online-course/

COURSE OUTCOMES:

`	**CO Statement**	**Knowledge Level**
CO 1	Understanding into the Concept of Green IT.	K1
CO 2	Discuss Green IT in relation to technology.	K1, K2
CO 3	Evaluate IT use in relation to enterprise IT readiness.	K2, K3
CO 4	Discuss the methods and tools to manage green IT.	K2, K3
CO 5	Conclude with a Green IT and AI tools to Environment Sustainability development.	K3, K4

MAPPING-CO with PO

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	2	3	2	2	2	2	3	3	3
CO 2	2	3	3	2	2	2	2	3	3	3
CO 3	2	3	3	2	2	2	2	3	3	3
CO 4	2	2	2	2	2	2	3	3	3	3
CO 5	2	2	2	2	2	2	3	3	3	3
Average	**2**	**2.4**	**2.6**	**2**	**2**	**2**	**2.4**	**3**	**3**	**3**

TEACHING METHODOLOGY:

Lecture by chalk and talk, Learning through Demonstrations, LCD Projectors, e-content, Group Discussion, Assignment, Quiz, Peer Learning and Seminar and online demonstrations.