

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credit Course on ‘HVAC systems for buildings - Design, Sizing & Selection’

Course Aim:

To provide a comprehensive understanding of HVAC systems used in buildings, equipping learners with the knowledge and skills required to design, size, and select suitable systems for various applications, ensuring energy efficiency and occupant comfort.

Learning Objectives

- Introduce the fundamental principles of HVAC systems and their importance in building environments.
- Enable participants to analyze building requirements for heating, cooling, and ventilation.
- Teach methodologies for proper sizing and selection of HVAC equipment.
- Highlight energy efficiency practices and sustainability in HVAC design.
- Develop practical skills to apply theoretical concepts through case studies and problem-solving.

Course Outcomes

1. Understand and explain the working principles of HVAC systems.
2. Assess and calculate heating, cooling, and ventilation loads for buildings.
3. Design and select HVAC equipment suitable for different building types.
4. Incorporate energy-efficient practices into HVAC design and operation.
5. Analyze and solve practical problems related to HVAC systems using industry standards.

Unit I: Introduction to HVAC Systems

[9 hours]

Basics of HVAC: Purpose and significance, Components of HVAC systems (heating, ventilation, air conditioning), Types of HVAC systems: Split, packaged, VRF, and central systems, Overview of building codes and standards (ASHRAE, ISHRAE)

Unit II: Heat Load Calculation & Psychrometrics

[9 hours]

Principles of heat transfer and their applications in HVAC, Methods for cooling and heating load calculations, Understanding and using psychrometric charts, Indoor air quality (IAQ) and thermal comfort.

Unit III: HVAC Equipment Design and Sizing

[9 hours]

Sizing of chillers, boilers, air-handling units (AHUs), and ductwork, Fan selection, pumps, and piping systems, Introduction to software tools for HVAC design (e.g., HAP, Carrier E20) Energy-efficient design considerations.

Unit IV: System Selection and Application

[9 hours]

Criteria for selecting appropriate HVAC systems, Case studies: Residential, commercial, and industrial applications, Integration with building automation systems (BAS), Emerging technologies in HVAC

Unit V: Energy Efficiency and Sustainability in HVAC**[9 hours]**

Energy management strategies in HVAC systems, Renewable energy integration (solar-assisted cooling, geothermal systems), Lifecycle cost analysis and maintenance practices and Green building certifications (LEED, BREEAM).

Total Lectures / Demo / Practicals / Case studies**[45 hours]****Reference Books:**

1. ASHRAE Handbook – Fundamentals (Latest Edition) by ASHRAE
Comprehensive guide on HVAC fundamentals, design calculations, and industry standards.
2. Modern Refrigeration and Air Conditioning by Althouse, Turnquist, and Bracciano
Focuses on the practical aspects of HVAC systems and refrigeration principles.
3. Principles of Heating, Ventilation, and Air Conditioning by Ronald Howell, William Coad, and Harry Sauer
A practical introduction to HVAC system design and application..

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credit Course on 'Energy Audit'

Course Aim:

To develop participants' expertise in conducting energy audits across various sectors, identifying inefficiencies, and recommending practical solutions to optimize energy consumption, reduce costs, and enhance sustainability.

Learning Objectives

- To introduce the fundamental concepts of energy audits and their role in energy conservation.
- To provide a detailed understanding of energy audit methodologies, tools, and techniques.
- To enable participants to analyze energy consumption patterns and identify inefficiencies.
- To equip learners with the skills to recommend and implement energy-saving measures.
- To familiarize participants with global standards, certifications, and reporting techniques in energy auditing.

Course Outcomes

1. Understand the principles and importance of energy auditing in energy conservation.
2. Conduct detailed energy audits for industrial, commercial, and residential facilities.
3. Identify energy inefficiencies and propose actionable recommendations for improvement.
4. Utilize energy audit tools and software effectively.
5. Prepare professional energy audit reports in compliance with global standards.

Unit 1: Introduction to Energy Auditing

[9 hours]

key principles and importance of energy auditing, exploring its scope and applications in diverse sectors. legal and policy frameworks that govern energy audits, Energy Conservation Act and ISO standards. difference between preliminary and detailed audits, offering a foundational understanding of audit processes.

Unit 2: Energy Audit Techniques and Tools

[9 hours]

technical methodologies used in energy audits, measurement and data analysis techniques. energy meters, power analyzers, and thermal imaging devices. Methods for analyzing energy flows, calculating energy performance indicators, and benchmarking energy. Practical exercises and case studies enhance the learning experience.

Unit 3: Energy Management and Optimization Strategies

[9 hours]

optimizing energy use across various systems, such as HVAC, lighting, motors, and boilers. energy-saving techniques, evaluate cost-benefit analyses of proposed measures, advanced technologies like smart meters, IoT, and AI in energy management. The integration of renewable energy systems into conventional frameworks.

Unit 4: Sector-Specific Energy Audit Applications

[9 hours]

distinct energy auditing requirements of industrial, commercial, and residential sectors. Participants will analyze energy consumption patterns in these sectors and design tailored energy conservation strategies. real-world examples and case studies to illustrate practical challenges and innovative solutions, emphasizing a hands-on approach to learning.

Unit 5: Reporting, Standards, and Certifications**[9 hours]**

comprehensive energy audit reports, detailing findings and actionable recommendations. global standards and certifications, such as ISO 50001, LEED, and BEE ratings. Emphasis is placed on the importance of stakeholder communication and presenting data effectively to promote energy efficiency projects.

Total Lectures / Demo / Practicals / Case studies**[45 hours]****Reference Books:**

1. **Energy Management Handbook** by Wayne C. Turner and Steve Doty
A detailed guide to energy management principles, tools, and practical applications.
2. **Handbook of Energy Audits** by Albert Thumann and Terry Niehus
Comprehensive coverage of energy audit procedures, instrumentation, and reporting.
3. **Energy Efficiency and Conservation Handbook** by Frank Kreith and D. Yogi Goswami
Focuses on strategies for improving energy efficiency and conservation across industries.
4. **Energy Audit of Building Systems: An Engineering Approach** by Moncef Krarti
Detailed insights into energy auditing for building systems, with a focus on energy savings.
5. **Industrial Energy Management and Utilization** by Larry C. Witte
Explores practical energy management techniques for industrial applications.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on 'Industry 5.0'

Course Aim:

To provide an in-depth understanding of Industry 5.0, focusing on the integration of human creativity with advanced technologies, fostering sustainability, and creating resilient and human-centric industrial systems.

Learning Objectives

- To introduce the concept and evolution of Industry 5.0 from previous industrial revolutions.
- To explore advanced technologies such as artificial intelligence, IoT, and robotics that drive Industry 5.0.
- To emphasize the importance of human-machine collaboration in achieving precision and innovation.
- To highlight the significance of sustainability and ethical practices in industrial transformation.
- To prepare participants to apply Industry 5.0 principles to design and implement intelligent systems.

Course Outcomes

- Understand the key principles and objectives of Industry 5.0.
- Analyze the role of emerging technologies in transforming industrial processes.
- Demonstrate knowledge of designing human-centric and sustainable industrial systems.
- Apply Industry 5.0 strategies to real-world industrial scenarios.
- Evaluate ethical and environmental challenges associated with Industry 5.0 adoption.

Unit 1: Introduction to Industry 5.0

[9 hours]

Evolution of industrial revolutions, focusing on the transition from Industry 4.0 to Industry 5.0., core principles of Industry 5.0, emphasizing human-centric design, sustainability and resilience. economic and social drivers propelling this industrial shift.

Unit 2: Technologies in Industry 5.0

[9 hours]

Role of enabling technologies, such as artificial intelligence (AI), machine learning, robotics, the Internet of Things (IoT), and blockchain, collaboration between humans and machines, enabling personalized and efficient production processes. Case studies illustrate real-world applications of these technologies.

Unit 3: Human-Machine Collaboration

[9 hours]

Synergy between human creativity and machine intelligence, cobots (collaborative robots), ergonomics in industrial design, and emotional intelligence in AI systems.

Unit 4: Sustainability and Ethics in Industry 5.0

[9 hours]

Sustainable development practices, including energy efficiency, waste minimization, and circular economy principles. Ethical considerations, such as job displacement, data privacy, and inclusivity in Industry 5.0, are discussed, global standards and certifications promoting sustainable industrial practices.

Unit 5: Implementation Strategies and Future Trends**[9 hours]**

Practical approaches to adopting Industry 5.0 principles in various industries. Change management, overcoming adoption challenges, and scaling technologies for different applications. Future trends, such as quantum computing and advanced materials.

Total Lectures / Demo / Practicals / Case studies**[45 hours]****Reference Books:**

1. **Industry 5.0: The Future of Industrial Automation** by Ravi Sharma
Comprehensive coverage of Industry 5.0 concepts, enabling technologies, and applications.
2. **The Next Industrial Revolution: Industry 5.0** by James Ross
Explores the human-centric and sustainable aspects of Industry 5.0 with real-world examples.
3. **Artificial Intelligence for a Better Future: AI, Ethics, and Society** by Bernd Carsten Stahl
Focuses on the ethical and societal implications of AI in Industry 5.0.
4. **Human-Robot Collaboration in Industrial Environments** by Niccolò Piacentini
A technical guide on human-robot collaboration and ergonomic design principles.
5. **Sustainable Manufacturing and Design** by Selim Ahmed
Provides insights into sustainable practices and the integration of green technologies in Industry 5.0.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Artificial Intelligence and Machine Learning’

Course Aim:

This course aims to provide students with a foundational understanding of Artificial Intelligence (AI) and Machine Learning (ML), focusing on their principles, techniques, and real-world applications. It emphasizes problem-solving, algorithm development, and the ethical considerations of implementing intelligent systems.

Learning Objectives

- Understand the fundamental concepts and principles of AI and ML.
- Learn the architecture, algorithms, and tools used in AI and ML development.
- Develop problem-solving skills by applying AI and ML techniques to real-world problems.
- Analyze and evaluate the performance of various AI/ML algorithms.
- Explore ethical, legal, and social implications of AI technologies.

Course Outcomes

- Demonstrate knowledge of AI and ML concepts and their applications in various industries.
- Design and implement AI and ML algorithms to solve complex problems.
- Use programming tools like Python and libraries such as TensorFlow and Scikit-learn for AI/ML development.
- Critically evaluate the performance and limitations of AI/ML systems.
- Address ethical challenges and propose responsible AI solutions.

Unit 1: Introduction to AI and ML

[9 Hours]

History, definitions, and scope of AI and ML, highlighting their interrelation. Key terminologies, AI problem-solving methods, supervised, unsupervised, and reinforcement learning, and an overview of AI applications in industries like healthcare, finance, and robotics.

Unit 2: Machine Learning Algorithms

[9 Hours]

Fundamental ML algorithms, including linear regression, logistic regression, decision trees, and support vector machines. It discusses feature engineering, overfitting, underfitting, and evaluation metrics like precision, recall, and F1 score.

Unit 3: Deep Learning and Neural Networks

[9 Hours]

Deep learning and neural networks, covering feedforward and convolutional networks, activation functions, and backpropagation. Practical applications like image recognition and natural language processing, and tools like TensorFlow and Keras.

Unit 4: AI Techniques and Applications

[9 Hours]

Search algorithms, knowledge representation, expert systems, and AI planning. Applications such as chatbots, recommendation systems, and intelligent agents are explored. Ethical considerations, bias mitigation, and interpretability of AI models.

Unit 5: Emerging Trends and Challenges**[9 Hours]**

Advancements in AI, including generative AI, federated learning, and quantum computing. Societal impacts, regulatory frameworks, and career opportunities in AI and ML. The challenges of data privacy, security, and AI ethics are emphasized.

Total Lectures / Demo / Practicals / Case studies**[45 hours]****Reference Books:**

- **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig, 4th Edition, Pearson, 2021.
- **Machine Learning** by Tom M. Mitchell, 1st Edition, McGraw Hill, 1997.
- **Deep Learning** by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 1st Edition, MIT Press, 2016.
- **Pattern Recognition and Machine Learning** by Christopher Bishop, 1st Edition, Springer, 2006.
- **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow** by Aurélien Géron, 2nd Edition, O'Reilly Media, 2019.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Industrial IOT’

Course Aim:

The course aims to provide a comprehensive understanding of the Industrial Internet of Things (IIoT), its architecture, components, and applications. It focuses on enabling learners to design and implement IIoT solutions for enhancing industrial efficiency, monitoring, and automation.

Learning Objectives

- Understand the fundamentals of IIoT and its role in modern industries.
- Explore IIoT architecture, protocols, and key enabling technologies.
- Analyze various IIoT applications across industries like manufacturing, energy, and logistics.
- Gain practical knowledge of IIoT platforms, sensors, and data analytics.
- Examine the challenges in IIoT deployment, including security and scalability.

Course Outcomes

- Demonstrate understanding of IIoT principles and their industrial applications.
- Design and deploy IIoT systems using sensors and communication protocols.
- Analyze industrial data for real-time monitoring and decision-making.
- Address security and privacy concerns in IIoT implementations.
- Evaluate the economic and operational benefits of IIoT solutions in various sectors.

Unit 1: Introduction to Industrial IoT

[9 Hours]

Overview of IIoT, its importance, and applications in industries. Study of IIoT architecture, key components, and differences between IoT and IIoT. Analysis of the impact of IIoT on industrial operations and business models.

Unit 2: IIoT Technologies and Communication Protocols

[9 Hours]

Key technologies enabling IIoT, including sensors, actuators, and edge devices. Introduction to communication protocols such as MQTT, CoAP, and OPC UA. Study of industrial networks like Modbus, Profibus, and Ethernet/IP.

Unit 3: Data Acquisition, Processing, and Analytics

[9 Hours]

Methods for collecting and processing industrial data using IIoT devices. Introduction to big data analytics, machine learning, and artificial intelligence in IIoT. Applications of predictive maintenance and condition monitoring through data analysis.

Unit 4: IIoT Platforms and Implementation

[9 Hours]

Overview of popular IIoT platforms like Azure IoT, AWS IoT, and Siemens MindSphere. Techniques for integrating hardware and software in IIoT systems. Study of cloud and edge computing for real-time data processing and decision-making.

Unit 5: Security and Future Trends in IIoT**[9 Hours]**

Examination of cybersecurity challenges in IIoT, including device authentication, data encryption, and network security. Exploration of emerging trends such as digital twins, 5G integration, and autonomous industrial systems. Case studies of successful IIoT implementations in industries.

Total Lectures / Demo / Practicals / Case studies**[45 hours]****Reference Books:**

- **Industrial Internet of Things: Cybermanufacturing Systems** by Sabina Jeschke, Christian Brecher, Houbing Song, and Danda B. Rawat, Springer, 2017.
- **Industrial IoT: Challenges, Design Principles, Applications, and Security** by Ismail Butun, Springer, 2020.
- **Building the Internet of Things** by Maciej Kranz, Wiley, 2016.
- **Internet of Things: A Hands-On Approach** by Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
- **Smart Sensors for Industrial Internet of Things** by Deepak Gupta, Vipin Kumar Jain, and Ashish Khanna, CRC Press, 2021.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Communication English’

Course Aim:

This course aims to enhance students' proficiency in English communication, focusing on improving their listening, speaking, reading, and writing skills for academic, professional, and social contexts. It emphasizes the development of effective communication strategies and intercultural awareness.

Learning Objectives

- Develop the ability to understand and use English effectively in real-world communication.
- Enhance fluency and accuracy in spoken and written English.
- Improve listening comprehension and reading skills through exposure to diverse texts and media.
- Build vocabulary and grammatical competence for better communication.
- Foster confidence in public speaking, group discussions, and professional interactions

Course Outcomes

- Demonstrate improved clarity and coherence in spoken and written English.
- Exhibit the ability to comprehend and interpret diverse texts and contexts.
- Apply appropriate communication strategies in professional and social settings.
- Participate effectively in discussions, presentations, and negotiations.
- Display cultural sensitivity and adaptability in communication.

Unit 1: Foundations of Communication

Overview of communication processes, verbal and non-verbal communication, barriers to effective communication, and strategies for overcoming them. Fundamentals of sentence structure, parts of speech, and basic grammar.

Unit 2: Listening and Speaking Skills

Techniques for active listening, note-taking, and comprehension of audio materials. Training in pronunciation, stress, intonation, and fluency. Practice in group discussions, role-plays, and interviews to enhance conversational skills.

Unit 3: Reading Skills and Comprehension

Strategies for skimming, scanning, and critical reading of texts. Analysis of essays, articles, and narratives to develop comprehension and interpretative abilities. Vocabulary-building exercises and context-based learning.

Unit 4: Writing Skills

Guidelines for constructing sentences, paragraphs, and essays. Writing formal letters, emails, and reports. Basics of creative writing, summarization, and paraphrasing. Emphasis on coherence, cohesion, and clarity in written communication.

Unit 5: Professional and Social Communication

Techniques for effective public speaking and presentations. Basics of professional etiquette, telephonic conversations, and email drafting. Insights into cross-cultural communication and handling workplace interactions.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

- **High School English Grammar and Composition** by Wren & Martin, Revised Edition, S. Chand Publishing, 2022.
- **Cambridge English Skills: Real Listening and Speaking** by Miles Craven, Cambridge University Press, 2008.
- **English for Effective Communication** by M.A. Pink and S.E. Thomas, Macmillan, 2010.
- **Communication Skills** by Sanjay Kumar and Pushp Lata, 2nd Edition, Oxford University Press, 2018.
- **Developing Communication Skills** by Krishna Mohan and Meera Banerji, 2nd Edition, Macmillan Publishers, 2009.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on 'Employability Skill Course'

Course Aim:

This course aims to equip students with essential skills to enhance their employability, including effective communication, problem-solving, teamwork, and professional ethics. It focuses on building confidence, adaptability, and career planning abilities to meet workplace demands.

Learning Objectives

- Develop interpersonal and communication skills to interact effectively in professional settings.
- Build problem-solving and critical thinking abilities for decision-making.
- Enhance teamwork and collaboration skills to function in diverse work environments.
- Foster time management, adaptability, and leadership capabilities.
- Prepare for job interviews, resume writing, and professional networking.

Course Outcomes

- Demonstrate effective communication and interpersonal skills in workplace scenarios.
- Solve problems and make informed decisions in professional contexts.
- Exhibit the ability to work cohesively within teams and adapt to workplace dynamics.
- Manage time efficiently and display leadership qualities.
- Present a professional resume and perform confidently in interviews.

Unit 1: Communication and Interpersonal Skills

[9 Hours]

Basics of verbal and non-verbal communication, active listening, and feedback techniques. Building interpersonal relationships through empathy, respect, and collaboration. Essentials of professional etiquette and workplace communication.

Unit 2: Problem-Solving and Critical Thinking

[9 Hours]

Approaches to identifying and analyzing problems, logical reasoning, and decision-making processes. Techniques for creative thinking and generating innovative solutions. Application of critical thinking in handling workplace challenges.

Unit 3: Teamwork and Leadership

[9 Hours]

Principles of effective teamwork, roles within teams, and conflict resolution. Leadership styles, motivational skills, and managing diverse teams. Case studies on successful team and leadership dynamics.

Unit 4: Time Management and Adaptability

[9 Hours]

Strategies for prioritizing tasks, setting goals, and avoiding procrastination. Coping with workplace changes and adapting to new roles and responsibilities. Building resilience and maintaining a work-life balance.

Unit 5: Career Planning and Professional Development

[9 Hours]

Guidelines for resume writing, cover letters, and creating a professional portfolio. Techniques for interview preparation and handling common interview scenarios. Importance of lifelong learning, professional networking, and personal branding.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

- **The 7 Habits of Highly Effective People** by Stephen R. Covey, 25th Anniversary Edition, Simon & Schuster, 2013.
- **Soft Skills: The Journey Begins** by K. Alex, 1st Edition, S. Chand Publishing, 2009.
- **Developing Employability Skills** by John Neugebauer and Jane Evans-Brain, 1st Edition, Oxford University Press, 2016.
- **How to Win Friends and Influence People** by Dale Carnegie, Updated Edition, Simon & Schuster, 2017.
- **The ACE of Soft Skills: Attitude, Communication, and Etiquette for Success** by Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson Education, 2010.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘English Language Skills for Employability’

Course Aim:

This course aims to enhance students' English language proficiency to improve their employability. It focuses on developing effective communication, presentation, and professional writing skills, ensuring students are well-prepared to meet workplace communication demands.

Learning Objectives

- Develop advanced listening and speaking skills for effective workplace communication.
- Enhance reading comprehension and analytical abilities through professional and technical texts.
- Strengthen writing skills for professional correspondence, reports, and presentations.
- Build confidence in public speaking and group discussions.
- Improve pronunciation, vocabulary, and grammatical accuracy.

Course Outcomes

- Demonstrate the ability to communicate effectively in professional and social contexts.
- Exhibit proficiency in reading and interpreting business-related texts.
- Write clear, concise, and professional documents.
- Participate confidently in interviews, group discussions, and presentations.
- Apply accurate grammar, pronunciation, and vocabulary in workplace scenarios..

Unit 1: Fundamentals of Communication

[9 Hours]

Principles of effective communication, types of communication, and overcoming barriers. Basics of English grammar, including tenses, articles, prepositions, and sentence formation. Importance of tone, clarity, and precision in professional communication.

Unit 2: Listening and Speaking for Workplace Communication

[9 Hours]

Listening for specific information, interpreting accents, and comprehending professional conversations. Speaking skills, including pronunciation, stress, and intonation. Role-plays, telephonic conversations, and interaction in workplace settings.

Unit 3: Reading and Understanding Professional Texts

[9 Hours]

Reading strategies such as skimming, scanning, and critical analysis. Comprehension of business documents, reports, and technical materials. Exercises to expand vocabulary and interpret context-specific language.

Unit 4: Professional Writing Skills

[9 Hours]

Constructing professional emails, memos, and business letters. Basics of report writing, agenda preparation, and drafting minutes of meetings. Writing personal statements, cover letters, and resumes for career advancement.

Unit 5: Presentation and Public Speaking**[9 Hours]**

Techniques for preparing and delivering effective presentations. Importance of visual aids and audience engagement. Training in group discussions, extempore speaking, and interview handling.

Total Lectures / Demo / Practicals / Case studies**[45 hours]****Reference Books:**

- **Communication Skills** by Sanjay Kumar and Pushp Lata, 2nd Edition, Oxford University Press, 2018.
- **Business Communication: Process and Product** by Mary Ellen Guffey and Dana Loewy, 9th Edition, Cengage Learning, 2019.
- **English for Business Communication** by Simon Sweeney, 2nd Edition, Cambridge University Press, 2003.
- **Developing Communication Skills** by Krishna Mohan and Meera Banerji, 2nd Edition, Macmillan Publishers, 2009.
- **Professional Writing Skills** by Natasha Terk, 1st Edition, ASTD Press, 2012.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Soft skills for 2nd year’

Course Aim:

To enhance students' interpersonal and professional skills, equipping them with the ability to interact effectively in diverse workplace settings while fostering confidence, teamwork, and adaptability.

Learning Objectives

- Develop effective communication and interpersonal skills.
- Strengthen time management and problem-solving capabilities.
- Enhance teamwork, leadership, and conflict-resolution skills.
- Foster adaptability and resilience in professional environments.
- Build confidence for interviews, presentations, and professional networking.

Course Outcomes

- Communicate effectively in professional and social contexts.
- Demonstrate leadership, teamwork, and problem-solving abilities.
- Manage time efficiently and prioritize tasks.
- Handle workplace challenges with adaptability and professionalism.
- Present confidently in interviews and discussions.

Unit 1: Communication and Interpersonal Skills

[9 Hours]

Principles of verbal and non-verbal communication, active listening, feedback, and building rapport. Importance of professional etiquette and maintaining relationships in diverse environments.

Unit 2: Time and Stress Management

[9 Hours]

Techniques for planning, prioritization, and effective goal-setting. Methods for handling stress, maintaining work-life balance, and increasing productivity in high-pressure scenarios.

Unit 3: Teamwork and Leadership

[9 Hours]

Essentials of teamwork, understanding roles, and resolving conflicts. Leadership qualities, styles, and motivating team members for shared goals. Case studies on workplace collaboration.

Unit 4: Problem-Solving and Decision-Making

[9 Hours]

Frameworks for critical thinking, analytical approaches, and decision-making strategies. Application of creative thinking to generate innovative solutions to real-world problems.

Unit 5: Career Skills and Professional Development

[9 Hours]

Preparation for interviews, resume building, and group discussions. Strategies for professional networking, personal branding, and continuous learning.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

- **Soft Skills: The Journey Begins** by K. Alex, S. Chand Publishing, 2009.
- **The 7 Habits of Highly Effective People** by Stephen R. Covey, Simon & Schuster, 2013.
- **Developing Soft Skills** by Nanda and Nanda, Pearson Education, 2011.
- **Emotional Intelligence** by Daniel Goleman, Bantam, 1995.
- **The ACE of Soft Skills** by Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson Education, 2010.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Electric Vehicle Technology and Manufacturing’

Course Aim:

To provide students with a comprehensive understanding of electric vehicle (EV) technology and the principles of EV manufacturing. This course focuses on the design, components, and production processes involved in creating sustainable and efficient electric vehicles.

Learning Objectives

- Understand the fundamentals of electric vehicles and their importance in sustainable transportation.
- Analyze the key components of EVs, including batteries, motors, and power electronics.
- Learn the manufacturing processes and materials used in EV production.
- Explore challenges in EV technology, including charging infrastructure and energy management.
- Gain knowledge of emerging trends and advancements in the EV industry.

Course Outcomes

- Explain the principles of electric vehicle technology and design.
- Evaluate the performance and efficiency of EV components.
- Apply knowledge of manufacturing techniques to EV production.
- Identify solutions to challenges in EV adoption and infrastructure.
- Demonstrate awareness of future trends and innovations in EV technology.

Unit 1: Introduction to Electric Vehicles

[9 Hours]

Evolution of electric vehicles, types of EVs, advantages over conventional vehicles, and environmental impact. Overview of EV architecture, classification, and current market trends.

Unit 2: EV Components and Systems

[9 Hours]

Battery technologies, energy storage systems, and battery management systems. Electric motors, power electronics, and drive systems. Regenerative braking and energy recovery techniques.

Unit 3: EV Manufacturing Processes

[9 Hours]

Material selection, design considerations, and assembly processes for EVs. Integration of electrical and mechanical systems. Role of automation and robotics in EV manufacturing. Safety standards and quality assurance in production.

Unit 4: Charging Infrastructure and Energy Management

[9 Hours]

Charging technologies, types of chargers, and charging standards. Grid integration, energy distribution, and smart charging systems. Challenges in infrastructure development and solutions.

Unit 5: Future Trends and Challenges in EVs

[9 Hours]

Emerging technologies such as solid-state batteries and wireless charging. Autonomous electric vehicles and connected mobility. Challenges related to cost, scalability, and environmental sustainability. Policies and incentives for promoting EV adoption.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

- **Electric Vehicle Technology Explained** by James Larminie and John Lowry, 2nd Edition, Wiley, 2012.
- **Modern Electric, Hybrid Electric, and Fuel Cell Vehicles** by Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz Ebrahimi, 3rd Edition, CRC Press, 2018.
- **Electric and Hybrid Vehicles: Technologies, Modeling, and Control** by Amir Khajepour, Saber Fallah, and Avesta Goodarzi, Wiley, 2014.
- **Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives** by Chris Mi, M. Abul Masrur, and David Wenzhong Gao, 2nd Edition, Wiley, 2017.
- **Manufacturing Processes for Engineering Materials** by Serope Kalpakjian and Steven R. Schmid, 6th Edition, Pearson, 2016.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on 'FLA- Full Load Amperes'

Course Aim:

The course aims to provide a foundational understanding of Full Load Amperes (FLA) and its significance in electrical systems. It focuses on analyzing the electrical load requirements for various devices and systems, enabling students to design, operate, and troubleshoot electrical circuits effectively.

Learning Objectives

- Understand the concept of FLA and its importance in electrical systems.
- Learn to calculate FLA for various electrical equipment, including motors and transformers.
- Gain knowledge about selecting appropriate circuit protection devices based on FLA.
- Explore the impact of FLA on power system design and energy efficiency.
- Develop practical skills to monitor and manage electrical loads.

Course Outcomes

- Demonstrate a clear understanding of FLA and its calculation.
- Analyze and select electrical components based on FLA values.
- Identify the implications of FLA in electrical design and safety.
- Apply knowledge of FLA to optimize energy efficiency and system reliability.
- Troubleshoot and address electrical load-related issues effectively.

Unit 1: Basics of Full Load Amperes (FLA)

[9 Hours]

Definition and importance of FLA in electrical systems. Differentiation between FLA and other current ratings such as inrush current and running current. Introduction to FLA measurement and its significance in system performance and safety.

Unit 2: Calculations and Applications of FLA

[9 Hours]

Methods to calculate FLA for various electrical devices, including motors, generators, and transformers. Analysis of formulas for single-phase and three-phase systems. Case studies on the practical application of FLA in system design.

Unit 3: Circuit Protection and Device Selection

[9 Hours]

Study of circuit breakers, fuses, and overload relays for electrical protection based on FLA. Guidelines for selecting appropriate wiring and protective devices. Importance of considering FLA in system reliability and fault tolerance.

Unit 4: Power System Design and Energy Efficiency

[9 Hours]

Role of FLA in load balancing, power factor correction, and minimizing energy losses. Strategies for efficient electrical design using FLA values. Overview of monitoring tools and techniques for load management.

Unit 5: Troubleshooting and Future Trends [9 Hours]

Identification and resolution of issues related to excessive current draw and improper load distribution. Overview of advanced metering and IoT-based solutions for load monitoring. Discussion on future trends in electrical system optimization.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

- **Electrical Wiring Commercial** by Phil Simmons, Cengage Learning, 16th Edition, 2020.
- **Electric Motor Maintenance and Troubleshooting** by Augie Hand, McGraw-Hill Education, 2nd Edition, 2011.
- **Electrical Power Systems Design and Analysis** by Mohamed E. El-Hawary, IEEE Press, 2nd Edition, 1995.
- **Handbook of Electrical Engineering** by Alan L. Sheldrake, Wiley, 2003.
- **Practical Electrical Wiring** by Herbert P. Richter and W. Creighton Schwan, Park Publishing, 2014.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Cyber Security’

Course Aim:

This course aims to provide a foundational understanding of cybersecurity concepts, techniques, and tools. It focuses on protecting computer systems, networks, and data from cyber threats and vulnerabilities while fostering a deep understanding of ethical and legal considerations in cybersecurity.

Learning Objectives

- Understand the fundamental principles and terminologies of cybersecurity.
- Identify and analyze common cyber threats, vulnerabilities, and attacks.
- Learn methods and tools to protect systems and networks from cyber threats.
- Gain knowledge of ethical hacking, cryptography, and incident response.
- Explore legal and regulatory aspects of cybersecurity.

Course Outcomes

- Demonstrate knowledge of cybersecurity principles and practices.
- Identify and mitigate security vulnerabilities in systems and networks.
- Utilize tools and techniques for cryptography and ethical hacking.
- Develop strategies to respond to and recover from cybersecurity incidents.
- Exhibit awareness of legal, ethical, and regulatory considerations in cybersecurity.

Unit 1: Introduction to Cybersecurity

[9 Hours]

Overview of cybersecurity, its importance, and key terminologies. Study of the CIA triad (Confidentiality, Integrity, Availability). Analysis of common cyber threats, including malware, phishing, ransomware, and denial-of-service attacks. Understanding risk assessment and threat modeling.

Unit 2: Network Security and System Protection

[9 Hours]

Introduction to network security principles, including firewalls, intrusion detection/prevention systems, and secure network protocols. Basics of securing operating systems and applications. Concepts of endpoint security and vulnerability management.

Unit 3: Cryptography and Data Security

[9 Hours]

Study of cryptographic techniques, including symmetric and asymmetric encryption, hashing, and digital signatures. Understanding key management and public key infrastructure (PKI). Application of cryptography for data protection in transit and at rest.

Unit 4: Ethical Hacking and Incident Response

[9 Hours]

Introduction to ethical hacking and penetration testing. Techniques for vulnerability assessment, reconnaissance, and exploiting weaknesses. Basics of incident response, including detection, analysis, containment, eradication, and recovery from cybersecurity incidents.

Unit 5: Legal, Ethical, and Emerging Trends in Cybersecurity

Overview of cybersecurity laws, regulations, and standards, including GDPR and ISO 27001. Study of ethical issues in cybersecurity. Exploration of emerging trends such as artificial intelligence in security, zero-trust architecture, and quantum cryptography.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

- **Cybersecurity Essentials** by Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short, Wiley, 2018.
- **Network Security Essentials: Applications and Standards** by William Stallings, 6th Edition, Pearson, 2017.
- **The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws** by Dafydd Stuttard and Marcus Pinto, 2nd Edition, Wiley, 2011.
- **Principles of Information Security** by Michael E. Whitman and Herbert J. Mattord, 6th Edition, Cengage Learning, 2017.
- **Applied Cryptography: Protocols, Algorithms, and Source Code in C** by Bruce Schneier, 2nd Edition, Wiley, 1995.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Cloud Computing’

Course Aim:

The course aims to provide students with an in-depth understanding of cloud computing principles, architecture, and services. It focuses on enabling learners to design, deploy, and manage cloud-based applications and explore its role in transforming IT and business processes.

Learning Objectives

1. Understand the fundamental concepts and models of cloud computing.
2. Explore various cloud service models such as IaaS, PaaS, and SaaS.
3. Learn the architecture and technologies behind cloud computing.
4. Gain practical knowledge of deploying applications on cloud platforms.
5. Analyze the challenges, security concerns, and solutions in cloud computing.

Course Outcomes

- Demonstrate understanding of cloud computing models and architecture.
- Apply knowledge to deploy and manage applications on cloud platforms.
- Identify and address security and scalability challenges in cloud environments.
- Evaluate the economic and operational benefits of cloud solutions.
- Utilize cloud services for effective data management and application hosting.

Unit 1: Introduction to Cloud Computing

[9 Hours]

Definition and characteristics of cloud computing, evolution of cloud technology, and comparison with traditional computing. Overview of cloud service and deployment models (Public, Private, Hybrid, and Community). Study of virtualization and its role in cloud computing.

Unit 2: Cloud Architecture and Technologies

[9 Hours]

Detailed examination of cloud architecture, including the front end, back end, and middleware. Technologies enabling cloud computing, such as distributed computing, multi-tenancy, and serverless computing. Analysis of cloud platforms like AWS, Microsoft Azure, and Google Cloud.

Unit 3: Cloud Services and Deployment

[9 Hours]

Study of Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Practical application of deploying virtual machines, storage solutions, and containerized applications. Introduction to APIs and microservices in cloud environments.

Unit 4: Security and Compliance in the Cloud

[9 Hours]

Discussion of cloud security challenges, including data breaches, identity management, and access control. Techniques for data encryption, multi-factor authentication, and secure storage. Overview of regulatory frameworks and compliance standards like GDPR, HIPAA, and ISO/IEC 27001.

Unit 5: Emerging Trends and Future of Cloud Computing

[9 Hours]

Study of advanced topics, including edge computing, hybrid cloud strategies, and AI in cloud services. Introduction to Kubernetes, Docker, and orchestration tools for container management. Analysis of cost management and optimization in cloud adoption.

Total Lectures / Demo / Practicals / Case studies

[45 hours]

Reference Books:

1. **Cloud Computing: Concepts, Technology & Architecture** by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Prentice Hall, 2013.
2. **Mastering Cloud Computing** by Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi, McGraw-Hill Education, 2013.
3. **Cloud Computing Bible** by Barrie Sosinsky, Wiley, 2011.
4. **Architecting the Cloud** by Michael J. Kavis, Wiley, 2014.
5. **Cloud Security and Privacy** by Tim Mather, Subra Kumaraswamy, and Shahed Latif, O'Reilly Media, 2009.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credits Course on ‘Green Skill Development’

Course Aim:

Support the students to develop their Entrepreneurship skills and doing Biobusiness in the sustainable environment by following Intellectual Property Rights, Patent Policies and Technology transfer methods.

Learning Objectives

- To enable the students to understand the sources of innovation opportunities and development of the skills to identify and analyze these opportunities for entrepreneurship and innovation.
- To develop personal skills set for creativity, innovation and entrepreneurship and specific concepts and tools for combining and managing creativity in organization.

Course Outcomes

1. Developing the students for creativity, responsibility, freedom to be able to decide what work one wants to do and how, dedication, diversity and last but not the least having fun and enjoying what one does.
2. Making the students to understand about the Biotechnology techniques, marketing of bioproducts and drugs.
3. Creating the students mindset towards start-up companies by using natural products and learning about bioethics issues in developing and marketing.
4. Learning about the entrepreneurial skills by using natural products and to develop the business strategy and technology Transfer towards earning

Unit I: Introduction to green skill development

[9 hours]

What are green skills?, Importance of Green Skill Development Programme, Financial or social constraints in green skill development, Green skilled workforce, Presentation, Communication, Listening, Interpersonal, Technical Writing, Computing, Research skills, Information, abilities, values and attitudes of green skills, National building code, IGBC, BEE, ASSOCHEM.

Unit II: Gardening Techniques

[9 hours]

Nursery development, Greenhouse and Glass house methods, Types of gardening, Terrace, Vertical, Kitchen, Zodiac, herbal and desert, Water Irrigation system, Soil analysis, Natural topography, Landscape design, Soil erosion control, Rain harvesting system, Horticulture techniques, Cultivation of *Spirulina* and *Azolla*.

Unit III: Entrepreneurship skills

[9 hours]

Entrepreneurship, Bioentrepreneurship, Biobusiness, Production of mushrooms, Single cell protein, Production of Organic manures, Biofertilizers, Biopesticides, Vermicompost

and Panchagavya, Aquarium development, Biogas, Bakery, Confectionary and Dairy products, Production of Areca plates, Bamboo basket, Paper Plates and Cups making.

Unit IV: Environment Sustainability Audits, ISO Procedures and IPR Policies [9 hours]

Introduction to green, environment, energy, hygiene, air, soil, water and waste management audits. Auditing techniques and implementation procedures, Commercialization, Business plan, Bank loan and Finance strategy, Marketing skills, International Standards (ISO 14001:2015, 50001:2018 and 17020:2012), Intellectual Property Rights (IPR), Patent Policies, Technology transfer.

Unit V: Case studies, Auditing Techniques and Audit Report Preparation [9 hours]

Case studies, Seminars, Assignment, Tutorials and Auditing exercises, Audited site visits and demonstrations, Audits groundwork, checklist preparation, Nursery development, Entrepreneurship, Bioentrepreneurship, Biobusiness- Real-time industry relevant examples.

Total Lectures / Demo / Practicals / Case studies / Auditing Hours [45 hours]

Text Books:

4. Ponmurugan, P., Philip Robinson, J. and Kalpana, B. 2011. "Guides to Entrepreneurship in Biotechnology", Anuradha Publishing Company, Chennai, India (ISBN: 978-81-907494-1-1), 306 Pages
5. Ponmurugan, P. and Nithya, B. 2009. "Guidelines for Entrepreneurship Development Programme for Biotechnology Graduates", Excel India Publishers, New Delhi, India (ISBN 93-80043-18-X), 180 Pages
6. Jogdand, S.N. 2007. Entrepreneurship and Business of Biotechnology, Himalaya Publishing House, Nagpur, Maharashtra.
7. Rajeev Yoy, 2011. Entrepreneurship, 2nd edition, Oxford Publications, London, UK.
8. Karthikeyan, S. and Arthur Ruf, 2009. Biobusiness. MJP Publications, Chennai, India.

Reference Books:

1. Oliver, R. 2000. The coming biotech age: The business of biomaterials, McGraw Hill, New York, US.
2. Shaleesha, S. 2008. Bioethics, Wisdom educational service, Chennai, India.
3. Ruth Ellen Bulger. 1993. The ethical dimensions of the Biological sciences, Cambridge University Press, New York, US.
4. Gurinder Shahi, 2004. BioBusiness in Asia: How countries Can Capitalize on the Life Science Revolution, Pearson Prentice Hall, New Delhi, India.
5. Thompson, D. 2018. *Tools for Environmental Management*. New Society Publishers, Gabriola Island, BC.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credit Course on 'Green Engineering'

Course Aim:

This course aims to help the interested students, staff and public to develop their skills to establish different types of gardens and design landscape for building construction and gardens to maintain the microclimatic condition without disturbing the natural vegetation.

Learning Objectives:

The students and staff members enable to

- Develop their employability skills in gardening and landscaping techniques.
- Make them better prepared to meet the local demands as well as develop their own interests and aptitudes.
- Produce skilled personnel in gardening and landscaping techniques.
- Familiarize with various plants, seedlings, irrigation, fertilizers, agrochemicals, tools and equipment used in the gardening and landscaping management.

Course Outcomes:

It is a skill development programme. So, the participants will be able to

1. Learn the basics of gardening and maintenance of plants, growth, and their uses for large scale applications.
2. Familiarize with various ornamental, medicinal and aromatic plants species for commercial exploitation.
3. Perform the various horticulture techniques for nursery development and management under field condition.
4. Learn about various designs and types of gardens and know how the landscaping is designed based on the topography.
5. Design the gardens innovatively based on the landscape pattern and they are confident enough to start their own business in gardening and landscaping.

Unit I: Introduction to Gardening and Establishment methods [9 hours]

Nature of gardening, historical background, principles of gardening, components, lawn making, glass house, green house, rockery, water garden, hydroponics and aeroponics. Horticulture techniques, grafting, seedling, cloning, Soil mixtures and seed beds, water and nutrition, fertilizer requirement, irrigation methods, gardening tools.

Unit II: Types of plants, gardens and various designs [9 hours]

Planting scheme of garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement and management. Layout of the different gardens and their designs, herbal garden, terrace garden, vertical garden, kitchen garden, zodiac garden, ornamental garden, desert garden, indoor garden, and public garden.

Unit III: Nursery development and other management practices [9 hours]

Plant nursery bed preparation, nursery layout, raising seedlings, cuttings, grafting, budding and layering techniques and root stock preparation, nursery management and transplantation of the seedlings, nutrients, water, weed, pest and disease management.

Unit IV: Role of vegetation in landscape design [9 hours]

Importance and scope of landscaping, landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of academic institutions, commercial, Government buildings, apartments/flats and public places, Role of natural vegetation in landscape design, landscaped parking.

Unit V: Green building environment and landscaping in India [9 hours]

Forest and vegetation types in Indian climatic conditions, recommended plant species for sustainable landscaping. Landscape design concepts, appropriate rainwater harvesting system, Persian gardens, British gardens in India, Organic gardening basics, Ecotourism impact, planning and development.

Total Lectures / Demonstrations / Case studies / Audited site visits [45 hours]

Text Books:

1. Vinoth Kumar, D., Rajalakshmi, S., and Sri Santhya, V. 2023. Techniques in Gardening. Laser Park Publishing House, Coimbatore, Tamil Nadu, India. 70 pages.
2. Kaushal Kumar Misra, 2011. Ornamental gardening in India. Biotech Books. 349 pages.
3. A handbook of Landscape – A Guide. 2013. Central Public Works Department. New Delhi. 154 pages.

Reference Books:

1. Gopaldaswami, I.K.S., 1970, Complete Gardening in India, Kalyan Press, Bangalore.
2. Pratibha P Trivedi 1987. Home Gardening. Indian Council of Agricultural Research ICAR. 340 pages.
3. Gardening - Step by Step Guide to Growing Natural Herbs and Remedies in Your Back Yard: (Gardening, Gardening for Beginners, Organic Garden, Perennial Vegetables, Home Garden, Horticulture)

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credit Course on ‘Environment Sustainability Audits’

Course Aim:

Support the Educational Institutions, Industries and Public sectors to implement ‘Environment Sustainability Audits’ to provide an ecofriendly atmosphere to various stakeholders and to provide solution for environmental problems.

Learning Objectives:

The students and staff members enable to

1. Understand the principles and importance of various audits in the context of the organization and risk assessment to Educational Institutions, Industries and Public sectors.
2. Study the concept on how to conduct Green, Environment, Energy, Waste Management, Hygiene, Water, Soil and Air quality audits’ at 360° view?.
3. Become the Lead Auditors, Technical Experts, Free Lancers and Entrepreneurs in the field Environment Sustainability 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, 45001:2018, 50001:2018 and 17020:2012.
2. Understand the audits groundwork, checklist preparation, practical auditing and auditing techniques, Audit/Non-conformity report preparation and submission.
3. Analyze how to help the Educational Institutions Industries and Public sectors to maintain the ecofriendly environment campus and personal hygiene to various stakeholders.
4. Study the methods of disposal, ways to reduce the wastes through carbon footprint, sequestration and neutralization methods 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: Green campus Audit Techniques and Implementation [9 hours]

Introduction to green campus audit, Audit procedures and target areas of green auditing, Flora and Fauna diversity, Natural topography, Vegetation, Landscape design, Soil erosion control, Pedestrian Path, Rain harvesting system, Different types of Gardening, Water Irrigation system.

Unit II: Environment Audit Techniques and Implementation [9 hours]

Environment friendly campus, Audit procedures and target areas of environment auditing, Carbon Footprint, Public transport, Low emitting vehicles and control of car smokes and exhausts, Recycling of wastes and wastewaters, Methods of wastes disposal, Biogas plant, Vermicompost.

Unit III: Energy Audit Techniques and Implementation [9 hours]

Energy Conservation Acts, Energy conservation building code, Objectives of energy audit, Energy auditing procedure, Instruments used for an energy audit, Renewable energy utilization, Energy conservation and saving opportunities, Solar panels & Water heaters.

Unit IV: Hygiene, Soil, Air and Water Audits Techniques and Implementation [9 hours]

Personal and environmental hygiene, water, Audit Procedures, Safety Rules for a hygiene Environment, Water, air and soil quality analysis. Use of O₂, CO₂, Light intensity, Sound level, Voltage, pH, TDS Meters, Salinity and Alkalinity Instruments in sample analysis.

Unit V: Waste Management Audits and ISO Procedures [9 hours]

Different types of Wastes, Plastic, Biomedical, Electronic, Construction & demolition wastes, Industrial wastes, Method of disposal, segregation and recycling methods, Wastewater treatment, Techniques and Implementation of waste management audits. International Standards on ISO 14001:2015, 45001:2018, 50001:2018 and 17020:2012.

Total Lectures / Demonstrations / Case studies / Audited site visits Hours [45 hours]

Text Books:

1. Gnanamangai, B.M., Muruganath, 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. Rajalakshmi, S., Kavitha, G. and Vinoth kumar, D. 2021. *Energy and Environment Management Audits*. AkiNik Publishing, New Delhi, India.
3. Pramanik, A.K. 2013. *Environmental Audit and Indian Scenario, Environmental Accounting and Reporting*. Deep and Deep Publications, New Delhi, India.
4. Rajalakshmi, S., Amzad Basha, K. and Asif Jamal, G.A. 2023. *A Manual on Waste Management Audit*. Laser Park Publishing House, Coimbatore, Tamil Nadu, India.

Reference Books:

1. Leal Filho, W., Muthu, N., Edwin, G. and Sima, M. 2015. *Implementing campus greening initiatives: approaches, methods and perspectives*. Springer, London, UK.
2. Roethlisberger, F.J. and Dickson, W.J. 2017. *Hygiene Management and its Implementation*. Harvard University Press. Cambridge, UK.
3. Thompson, D. 2018. *Tools for Environmental Management*. New Society Publishers, Gabriola Island, BC.

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credit Course on ‘Carbon auditing and Management’

Course Aim:

This course aims to help the interested students, staff and general public to identify where to focus carbon emissions reduction efforts, develop a strategy and track the impact of emissions reduction initiatives.

Learning Objectives:

The students and staff members enable to

1. Develop their employability skills as a Carbon Auditor.
2. Step forward to reduce the alarming impact due to carbon emission
3. Carbon capture and accounting
4. Be a milestone to reduce the carbon emission

Course Outcomes:

The participants will be able to

1. Learn the basics of carbon and its impacts.
2. Advancements in carbon trading and sequestration
3. Know the ways to reduce carbon emission.
4. Learn about GHG in line with International Standards.
5. Be a trained carbon auditor to Measure, analyze and report on Green House Gas Emission produced by an Individual, Organization or event.

Unit I: Introduction to Carbon [9 hours]

Introduction, King of elements, Types, Characteristics and it's properties, Carbon allotrope with examples, Uses of carbon and it's compounds, Carbon footprint, Carbons role in current affairs, Advantages and Disadvantages, The principles of carbon cycles and climate change.

Unit II: Carbon sequestration [9 hours]

Green, Blue and Brown Carbon. About storage in ecosystem, Role in mitigation, Vulnerability, Importance and Global policy initiatives. Carbon sequestration and climate change mitigation, carbon capture and storage, challenges and limitations of carbon sequestration, the future of carbon sequestration.

Unit III: Carbon Accounting and Trading [9 hours]

Carbon accounting overviews, importance, Five Principles, accounting for suppliers' emission, calculating emissions, challenges. Concepts of carbon trading, types, regional carbon trading markets, Carbon trading post Glasgow COP26, advantages and disadvantages, Techniques for carbon sequestration, carbon neutralization, and offsetting.

Unit IV: Green House Gas Emission in line with the International Standards [9 hours]
ISO 14064-1:2018, ISO 14064-2:2019 and ISO 14064-3:2019 – Green House Emission Standards, ISO 14067:2018 – Green House Gases – Carbon foot print of products – Requirement and Guidelines for Quantification and Applying tools and methods for carbon accounting and reporting in line with international standards.

Unit V: Principles of Carbon Audit and Management [9 hours]
Role of carbon in the global economy and its impact on business strategies, Regulatory frameworks and policies related to carbon management, importance and scope of carbon audit, checklist, Measurement, management, and reduction of carbon emission in various sectors.

Case Studies: Site visit and groundwork, checklist preparation, conformity and non-conformity report preparation, Recommendations and suggestions after audit to the auditees.

Total Lectures / Demo / Practicals / Case studies / Auditing Hours [45 hours]

Text Books:

1. Shelley W. W. Zhou, Carbon Management for a Sustainable Environment, 2020, Springer International Publishing, Singapore.
2. A protocol for measurement, monitoring, reporting and verification of soil organic carbon in agricultural landscapes (FAO)
<https://www.fao.org/documents/card/en/c/cb0509en/>
3. The Carbon Footprint Handbook" by Ian Martin and Paul McKeigue
4. Climate Change and Carbon Markets: A Handbook of Emissions Reduction Mechanisms" by Farhana Yamin and Jørgen Wettestad, London, UK.

Reference Books:

1. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Intergovernmental Panel on Climate Change, 2006.
2. Carbon Markets 101: A Handbook" by Rupesh Madlani and Nick Robins
3. Carbon Finance: The Financial Implications of Climate Change" by Sonia Labatt and Rodney R. White
5. The Handbook of Carbon Offset Programs: Trading Systems, Funds, Protocols and Standards" edited by Anja Kollmuss, Michael Lazarus and Carrie Lee

NATURE SCIENCE FOUNDATION, COIMBATORE, TAMIL NADU

Syllabus of Two Credit Course on ‘AI Technology in Environment Sustainability Audits’

Course Aim:

The course aims to explore the intersection of emerging AI technologies in environment sustainability audits, emphasizing how AI can address environmental challenges.

Learning Objectives:

The students and staff members enable to

4. Understand the principles and importance of AI technologies by fosters critical thinking on ethical implications and innovative solutions for a greener future.
5. Study the concept on how AI's role in promoting environment sustainable practices?.
6. Become a Lead Auditor, Consultant and Entrepreneur in the field of Green, Energy and Environment Audits to provide solution for environmental problems using AI technologies.

Course Outcomes:

- **Proficiency in AI for Sustainability:** Gain a deep understanding of how AI technologies can be applied to solve environment sustainability challenges and drive positive environmental outcomes.
- **Ethical and Responsible AI Deployment:** Demonstrate the ability to assess and implement AI solutions with a strong awareness of ethical considerations and societal impacts.
- **AI-Driven Solutions:** Acquire the technical skills to design, develop, and deploy AI-driven solutions that enhance environment sustainability across various industries.
- **Critical Evaluation of AI Initiatives:** Develop the ability to critically evaluate the effectiveness of AI applications in environment sustainability projects, identifying areas for improvement and innovation.
- **Interdisciplinary Collaboration Skills:** Build the capability to work effectively with multidisciplinary teams, integrating AI expertise with environmental science, policy, and business strategies to promote sustainable development.

Unit I: Introduction and Importance of Environment sustainability audits [9 hours]

Introduction to environment sustainability, Scope and Importance, Types of audits: Green, Environment, Energy, Waste Management, Soil, Water, Air Quality, Hygiene, Fire Safety, Life Safety and Carbon audits, Audit process, methodology and report writing.

Unit II: Environment sustainable parameters of audits [9 hours]

Understanding the concepts of natural topography, vegetation and monitoring, Landscape design and soil erosion control, Gardening types, Green building conservation code, Measurement of oxygen, carbon di oxide, light intensity, sound level and voltage in current flow of AC and DC. Carbon emission from Public transport, low emitting vehicles and control of car smokes.

Unit III: Energy Conservation Acts and testing tools [9 hours]

Energy Conservation Acts, Energy conservation and saving opportunities, Renewable and Non-renewable energy utilization, Energy Consumption Forecasting and Smart Grid Management, Vehicle emission testing tools, Fuel emission analyzers, Energy modelling software.

Unit IV: AI Tools & Technologies in Environment Sustainability Audits [9 hours]

Introduction of Artificial Intelligence, Development of software for green, environment and energy audits, Detection devices, Building information modelling software, Green building rating system, Building Life cycle assessment software, AI in Water management and quality monitoring, AI in Air quality monitoring, Geographic Information System (GIS), Drone based technology in green campus and environment assessment.

Unit V: ICT and IoT approaches in environment Sustainability Audits [9 hours]

AI-driven solutions for environment sustainable development goals (SDGs), Ethical considerations in applying AI to environment sustainability; ICT tools for data collection and analysis, IoT (Internet of Things), Big data analytics and Cloud computing; Machine Learning technique in energy efficiency, Image processing techniques in flora and fauna, Biodiversity Conservation Web-Portal.

Total Lectures / Demo / Practicals / Case studies / Auditing Hours [45 hours]

Text Books:

1. Gnanamangai, B.M., Muruganath, 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. Rajalakshmi, S., Kavitha, G. and Vinoth kumar, D. 2021. *Energy and Environment Management Audits*. AkiNik Publishing, New Delhi, India.
3. 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.
4. Zhou, W.W.S. 2020. *Carbon Management for a Sustainable Environment*. Springer Nature, Switzerland.

Reference Books:

1. Wolfgang Ertel, 2018. *Introduction to Artificial Intelligence. Second Edition, Springer, The Netherlands.*
2. Russell, S. and Norvig, P. 2024. *Artificial Intelligence: A Modern Approach. Pearson, Global edition, London, UK.*
3. Gupta, R.K., Jain, A., Wang, J. and Pateriya, R.K. 2024 *Reshaping Environmental Science Through Machine Learning and IoT.* IGI Global, Hershey, US.
4. 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.