**VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR**

**Nature of Certification: Post graduate diploma**

**Title of Course: Post Graduate Diploma in Smart Factories and Digital Manufacturing**

**Proposed Maximum Duration**: 1 year

**Total Hours**: 480 hours

**Mode of course delivery**: Hybrid

**Offered by**: V. R. Jamdar Siemens Center of Excellence, VNIT Nagpur (Interdisciplinary)

**Eligibility**: B.Tech (Any) Completed / M.Tech (Any) Ongoing

**Course Objective:**

1. Understand the principles and concepts of smart factories and digital manufacturing, including their architecture, technologies, and applications in modern industrial settings.

2. Develop expertise in the design and implementation of digital manufacturing systems, including the use of sensors, data acquisition systems, wireless communication protocols, and cloud-based platforms.

3. Develop skills in cybersecurity and risk management for smart factories and digital manufacturing systems, including the identification of potential threats and vulnerabilities, and the implementation of appropriate security controls.

4. Learn how to use AR/VR/MR technologies to enhance the design, testing, and manufacturing processes, including the creation of digital twins for virtual prototyping and simulation.

5. Develop skills in advanced data analytics techniques, such as machine learning and artificial intelligence, to optimize manufacturing processes and improve product quality.

**Course Structure:**

| Year | Sem | Course Code | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|---|
| First | 1st | PGDSFDM401 | Industry 4.0 Fundamentals | 3 | 0 | 0 | 3 |
| First | 1st | PGDSFDM 402 | Mathematics for AI and ML | 2 | 1 | 0 | 3 |
| First | 1st | PGDSFDM 403 | Digital Manufacturing | 0 | 0 | 6 | 3 |
| First | 1st | PGDSFDM 404 | AI, ML, Analytics | 3 | 1 | 0 | 4 |
| First | 1st | PGDSFDM 405 | Robotics and Autonomous Systems | 1 | 1 | 4 | 4 |
| First | 1st | PGDSFDM 406 | Cybersecurity | 3 | 0 | 0 | 3 |
| | | | | | | Sub Total | 20 |
| First | 2nd | PGDSFDM 407 | Mechatronics and Automation | 1 | 0 | 6 | 4 |
| First | 2nd | PGDSFDM 408 | AR/VR/MR/Haptics | 3 | 0 | 2 | 4 |
| First | 2nd | PGDSFDM 409 | IoT and Digital Twin | 1 | 0 | 6 | 4 |
| First | 2nd | PGDSFDM 410 | Professional Development | 1 | 0 | 2 | 2 |
| First | 2nd | PGDSFDM 411 | Industrial Case Study | 0 | 0 | 6 | 3 |
| First | 2nd | PGDSFDM 412 | Industry Project | 0 | 0 | 6 | 3 |
| | | | Subtotal | 18 | 3 | 19 | 20 |
| | | | Total | | | | 40 |

**Course outcomes:**

1. Develop a deep understanding of the principles and concepts of smart factories and digital manufacturing, and how to apply them to modern industrial settings.

2. Gain practical skills in the design and implementation of digital manufacturing systems, including the use of sensors, data acquisition systems, wireless communication protocols, and cloud-based platforms.

3. Learn how to use AR/VR/MR technologies to enhance the design, testing, and manufacturing processes, including the creation of digital twins for virtual prototyping and simulation.

4. Gain expertise in advanced data analytics techniques, such as machine learning and artificial intelligence, to optimize manufacturing processes and improve product quality.

5. Develop skills in implementing digital twin technology for product design, optimization, and prototyping.

6. Gain proficiency in analytics techniques for monitoring and optimizing production processes, including statistical process control, predictive maintenance, and anomaly detection.

**Attendance:** As per institute rule book. (100 % mandatory, 25% relaxation may be given by course coordinator)

**Course Evaluation:** Mid-term (30%) + End Term(30%) + Teacher's Assessment (40% which includes project)

**Course Fees:** Rs. 1,20,000 + 18% GST

**Course Proposed by VRJSCOE Team to BoS (Interdisciplinary Studies)**

**Course Coordinators:**

Prof. A. B. Andhare
(Professor Incharge, Smart Factory Lab of VRJSCOE)

Dr. Ravindra Keskar
(Professor Incharge, Advanced Manufacturing Lab of VRJSCOE)

Dr. D. A. Jolhe
(Professor Incharge, Advanced Manufacturing Lab of VRJSCOE)

Dr. Araghya Mitra
(Professor Incharge, Automation Lab of VRJSCOE)

Dr. Pradyuman Chaturvedi
(Professor Incharge, Mechatronics Lab of VRJSCOE)

Prof. U. A. Deshpande
(Professor Incharge, IoT Lab of VRJSCOE)

Dr. Poonam Sharma
(Professor Incharge, Robotics Lab of VRJSCOE)

**Lab Coordinator(s):**
Trainers for Smart factory, Advance Manufacturing, Automation, Mechatronics, IoT, Robotics Labs of VRJSCOE and Center Manager

**Course Execution Coordinator:**
Prof. Shital S. Chiddarwar
Center Head
V R Jamdar Siemens CoE

Syllabus for PGDSFDM401-Industry 4.0 Fundamentals (3-0-0-3)

Introduction to Industry 4.0, Evolution of manufacturing: From Industry 1.0 to Industry 4.0, Key concepts and principles of Industry 4.0, Digital transformation in manufacturing

, Cyber-Physical Systems (CPS) and Internet of Things (IoT), Basics of Cyber-Physical Systems (CPS) and their applications in manufacturing

Introduction to the Internet of Things (IoT) and its role in Industry 4.0, IoT technologies, sensors, and communication protocols

Big Data and Analytics for Smart Manufacturing, Data acquisition, data processing, and data analytics for smart manufacturing, Predictive analytics, prescriptive analytics, and machine learning in manufacturing

Cloud Computing and Edge Computing in Industry 4.0, Overview of cloud computing and edge computing, Cloud-based and edge-based solutions for smart manufacturing, Cybersecurity considerations

Artificial Intelligence (AI) and Machine Learning (ML) in Manufacturing, Applications of AI and ML in manufacturing processes, quality control, and predictive maintenance, Challenges and ethical considerations of AI and ML in manufacturing

Additive Manufacturing and Robotics in Industry 4.0, Overview of additive manufacturing (3D printing) and its role in Industry 4.0, Robotics and automation in smart manufacturing, Collaborative robots, autonomous robots, and cobots in manufacturing

Digital Twins and Virtual Reality (VR) in Manufacturing, Understanding digital twins and their applications in manufacturing, Virtual reality (VR) and augmented reality (AR) in smart manufacturing, Virtual prototyping, simulation, and training in manufacturing processes

Cybersecurity and Data Privacy in Industry 4.0, Cybersecurity threats and challenges in smart manufacturing, Best practices for securing cyber-physical systems (CPS) and IoT devices, Data privacy regulations and compliance in Industry 4.0

Case Studies and Real-World Examples of Industry 4.0 Implementations, success stories and case studies from different sectors, Best practices and lessons learned from Industry 4.0 implementations, Industry-specific applications and challenges in smart manufacturing, Future Trends and Emerging Technologies, Current trends and future directions, Emerging technologies and their potential impact on smart manufacturing, Opportunities and challenges of Industry 4.0 for the future

Text Books:


1. Handbook of Industry 4.0 and SMART Systems, Diego Galar Pascual , Pasquale Daponte , Uday Kumar, CRC Press, 2019
2. Industry 4.0: Increasing the Competitiveness of Industrial Manufacturing, Published by Intueri, white paper
3. Fourth Industrial Revolution, Klaus Schwab, Portfolio Penguin, 2017


Syllabus for PGDSFDM 402-Mathematics for AI and ML (2-1-0-3)

Linear Algebra for AI and ML, Vectors and matrices: operations, properties, and applications in AI and ML, Linear transformations and their role in data transformations, Eigenvalues, eigenvectors, and their significance in machine learning algorithms, Matrix decompositions: LU, QR, and Singular Value Decomposition (SVD)

Probability and Statistics for AI and ML, Probability theory: basics, conditional probability, and probability distributions, Statistical measures: mean, median, mode, variance, and standard deviation, Statistical inference: hypothesis testing, confidence intervals, and p-values, Probability distributions: Gaussian, Binomial, Poisson, and their applications in AI and ML

Calculus for AI and ML, Basics of calculus: limits, derivatives, and integrals, Gradient, Hessian, and their role in optimization algorithms, Multivariate calculus: partial derivatives, chain rule, and gradient descent, Applications of calculus in optimization, loss functions, and training machine learning models

Optimization Techniques for AI and ML, Convex optimization: convex sets, convex functions, and convex optimization problems, First-order optimization algorithms: gradient descent, stochastic gradient descent, Second-order optimization algorithms: Newton's method, Quasi-Newton methods, Regularization techniques: L1, L2, and Elastic Net regularization

Machine Learning Algorithms and Techniques, Supervised learning: linear regression, logistic regression, support vector machines, decision trees, and ensemble methods, Unsupervised learning: k-means clustering, hierarchical clustering, dimensionality reduction techniques (PCA, t-SNE), and association rule mining

Deep learning: basics of artificial neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep reinforcement learning

Evaluation metrics for machine learning models: accuracy, precision, recall, F1-score, ROC-AUC, and cross-validation

Time Series Analysis for AI and ML, Basics of time series data: components, stationarity, and autocorrelation, Time series forecasting techniques: autoregressive models (AR), moving average models (MA), autoregressive integrated moving average (ARIMA), seasonal decomposition of time series (STL), and Prophet

Advanced time series forecasting techniques: Vector Autoregression (VAR), Seasonal Autoregressive Integrated Moving-Average (SARIMA), Seasonal Autoregressive Integrated Moving-Average with Exogenous Regressors (SARIMAX), and Long Short-Term Memory (LSTM) networks

Text books


1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press , 2012
2. Linear Algebra and Optimization for Machine Learning: A Textbook, Charu C. Aggarwal, Springer; 1st ed. 2020
3. Time Series Analysis and Its Applications: With R Examples (Springer Texts in Statistics), Robert H. Shumway, David S. Stoffer, Springer; 3rd ed. 2011 edition


Syllabus for PGDSFDM 403-Digital Manufacturing (0-0-6-3)

Introduction to Digital Manufacturing, Overview of the digital manufacturing process, History of digital manufacturing and its evolution, Digital manufacturing technologies and their applications, Challenges and opportunities in digital manufacturing

Computer-Aided Design (CAD), Basics of CAD software and its applications, 2D and 3D modeling techniques for digital design, Design optimization using CAD tools, CAD data formats and their interoperability

Computer-Aided Manufacturing (CAM), Basics of CAM software and its applications, CAM techniques for CNC machining, additive manufacturing, and other processes, CAM optimization techniques for process planning, CAM data formats and their interoperability

Digital Twin Technology, Concept of digital twin and its applications in manufacturing, building a digital twin: data collection, modeling, and simulation, Use of digital twins in product development, production planning, and maintenance, Case studies on digital twin implementations in industry

Additive Manufacturing (AM), Overview of AM technologies and their applications, AM materials and their properties, AM design techniques and optimization, AM process control and quality assurance

Robotics and Automation in Manufacturing, Overview of robotics and automation in manufacturing, Types of robots and their applications in manufacturing, Robot programming and control techniques, Collaborative robots and their use in digital manufacturing

Future of digital manufacturing and its impact on the manufacturing industry.

Text Book:

1. Digital Manufacturing The Industrialization of "Art to Part" 3D Additive Printing, 1st Edition, 2022, Elsevier

2. Digital Manufacturing for SMEs, Jack C Chaplin, Claudia Pagano, Santi Fort, ERASMUS+ project Digit-T: Digital Manufacturing Training System for SMEs (2017-1-UK01-KA202-036807)

3. Digital Twin: A Complete Guide For The Complete Beginner, Vijay Raghunathan, Santanu Deb Barma, Kindle store, 2017

4. Building Industrial Digital Twins: Design, develop, and deploy digital twin solutions for real-world industries using Azure Digital Twins, Shyam Varan Nath, Pieter van Schalkwyk, Packt Publishing; 1st edition,2021

Syllabus for PGDSFDM 404- AI, ML, Analytics (3-1-0-4)

Introduction to AI, ML, and Analytics in Manufacturing, Role of AI, ML, and analytics in improving manufacturing processes, productivity, and quality, challenges and opportunities of using AI, ML, and analytics in manufacturing

Data Collection and Pre-processing for Manufacturing, Basics of data collection techniques in manufacturing, such as sensors, SCADA systems, and MES, Data preprocessing techniques, including data cleansing, normalization, and feature extraction, Data integration and data quality management for manufacturing applications, Data visualization and exploration for manufacturing analytics

Predictive Analytics for Predictive Maintenance, Basics of predictive maintenance and its applications in manufacturing, Techniques for predictive analytics, including statistical methods, machine learning algorithms, and time-series analysis, Predictive maintenance use cases in manufacturing, such as equipment failure prediction, anomaly detection, and remaining useful life estimation, Implementation and evaluation of predictive maintenance models in smart factories

Machine Learning for Quality Control, Basics of quality control in manufacturing and its importance, Machine learning techniques for quality control, including classification, regression, and anomaly detection, Statistical process control (SPC) using machine learning, Real-time quality monitoring and control using ML algorithms in smart factories

Optimization and Simulation for Manufacturing, Optimization techniques for process and production planning in manufacturing, Simulation techniques for modeling and analyzing manufacturing systems

Applications of AI and ML in optimization and simulation for digital manufacturing, Use of digital twins and virtual simulations for process optimization in smart factories, Supply Chain Analytics in Digital Manufacturing, Applications of AI, ML, and analytics in supply chain optimization, demand forecasting, inventory management, and logistics, Data-driven decision-making in supply chain using AI and analytics

AI and ML for Additive Manufacturing, Machine learning techniques for AM process monitoring, defect detection, and material optimization, Design for AM using AI and ML algorithms, Optimization of AM process parameters using AI and ML techniques

Applications of AI and ML in robotics and automation in manufacturing, AI and ML techniques for robot perception, motion planning, and control, Collaborative robots and human-robot interaction in smart factories

Ethical considerations, Security and privacy concerns in data-driven manufacturing, Legal and regulatory aspects of AI and ML in manufacturing, best practices for ethical and secure use of AI and ML in digital manufacturing

Text Book:


1. Data Science for Business and Decision Making, Luiz Favero, Patrícia Belfiore, 1st Edition 2019, Elsevier
2. Supply Chain Analytics, T. A. S. Vijayaraghavan, Wiley India Pvt Ltd, 2021
3. Robotics: What Beginners Need to Know about Robotic Process Automation, Mobile Robots, Artificial Intelligence, Machine Learning, Autonomous Vehicles, Speech Recognition, Drones, and Our Future, Neil Wilkins, Independently Published, 2019


Syllabus for PGDSFDM 405- Robotics and Autonomous Systems (1-1-4-4)

Introduction to Robotics and Autonomous Systems, History and evolution of robotics, Types of robots and their applications, Key components of a robot system, Sensors and actuators for robotics, Overview of autonomous systems

Robot Kinematics and Dynamics, Introduction to robot kinematics and dynamics, Forward and inverse kinematics, Robot motion planning and control, Trajectory generation for robots, Robot dynamics and stability

Perception for Robotics, Basics of perception for robots, Sensor fusion techniques, Computer vision for robots, Simultaneous Localization and Mapping (SLAM), Object recognition and tracking for robots

Navigation and Localization, Navigation algorithms for robots, Path planning and obstacle avoidance, Localization techniques for autonomous systems, Simultaneous Localization and Mapping (SLAM) algorithms, Real-time localization and mapping for autonomous robots

Overview of autonomous systems and their applications, Autonomous drones and their challenges, Autonomous vehicles and self-driving cars, Autonomous robots for manufacturing and logistics, Emerging applications of robotics and autonomous systems

Text Books:


1. Introduction to Autonomous Mobile Robots, second edition (Intelligent Robotics and Autonomous Agents series), Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza , 2011, The MIT Press; second edition
2. Introduction to Autonomous Robots, Nikolaus Correll, 2020, Open Textbook


Syllabus on PGDSFDM 406- Cybersecurity (3-0-0-3)

Introduction to Cybersecurity, Overview of cybersecurity concepts, Importance of cybersecurity in modern society, Threat landscape and types of cyber threats, Cybersecurity goals: confidentiality, integrity, availability, Legal and ethical considerations in cybersecurity

Fundamentals of Information Security, Basic principles of information security, Risk management and risk assessment, Security policies, standards, and frameworks, Access control and authentication, Security awareness and training

Network Security, Fundamentals of network security, Network architecture and protocols, Common network attacks and defences, Firewalls, IDS, and IPS, Virtual private networks (VPNs) and secure remote access

Cryptography, Introduction to cryptography, Symmetric and asymmetric encryption, Hash functions and digital signatures, Public key infrastructure (PKI), Cryptographic protocols and applications

Web Security, Web architecture and protocols, Common web vulnerabilities (e.g., SQL injection, XSS, CSRF), Web application security best practices, Secure coding principles and techniques, Web security tools and testing methodologies, Week 6: Malware and Social Engineering

Overview of malware types (e.g., viruses, worms, ransomware), Malware detection and prevention techniques, Social engineering attacks and defences, Phishing, spear-phishing, and other social engineering attacks, Human factors in cybersecurity and user awareness

Emerging Topics in Cybersecurity, Emerging trends and challenges in cybersecurity, Internet of Things (IoT) security, Cloud computing security, Artificial intelligence (AI) and machine learning in cybersecurity, Future directions and career opportunities in cybersecurity

Text Books:


1. Cybersecurity: The Beginner's Guide, Erdal Ozkaya, Packt Publishing House, 2019
2. Social Engineering: The Science of Human Hacking, Christopher Hadnagy, Gildan Audio and Blackstone Publishing; Unabridged edition, 2021

Introduction to mechatronics, What is mechatronics? The design process, Systems, Measurement systems, Control systems , Programmable logic controller, Examples of mechatronic systems

Sensors and signal conditioning, Sensors and transducers, Signal conditioning, Digital signals, Digital logic, Data presentation systems

Actuation, Pneumatic and hydraulic actuation systems, Mechanical actuation systems, Electrical actuation systems

Microprocessor systems, Microprocessors and microcontrollers, Assembly language, C language, Input/output systems, Programmable logic controllers, Communication systems, Fault finding

Introduction to the basics of PLC. The topics will be covered such as PLC Definition and types, PLC architecture, Hardware and signals introduction to various sensors which are used as input and output devices used in Automation and application- Sinking and Sourcing Introduction of TIA portal software S7-1200 PLC selection and configuration in different views like portal view and project view, communication settings, software features introduction to the Basic notations of PLC programming and Basic Bit logic operations such as NO, NC and Output

Programming of Basic gate functions such as AND, OR, NOR etc., Comparator Functions Introduction to S7-1200 CPU memory, function block, and data blocks Programming using math functions, counter, timer

S7-1500 plc mounting, selection and configuration, communication settings Introduction ofs7-1500 CPU memory, the I/O section, Discrete I/O modules, Analog I/modules Introduction to HMI KTP-700 & TP-700 HMI mounting, power up, wiring, selection and configuration in TIA Portal, communication settings, interface with s7-1500 plc

Introduction to SCADA, Communication between PLC and SCADA, Application development in SCADA Trends (Tag Logging) Alarms

Text Books:


1. Mechatronic Systems Design and Solid Materials by Satya Bir Singh; Prabhat Ranjan (Editor); Alexander V. Vakhrushev ; A. K. Haghi, CRC Press, 2021
2. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, W. J. Bolton, 7 th Edition, 2022
3. Siemens PLC Easy Book, https://euroec.by/assets/files/siemens/s71200_easy_book_en-US_en-US.pdf

Introduction to AR/VR/MR/Haptics, Overview , Brief history and evolution, Key concepts and terminology, Applications and use cases in various fields, Ethical considerations and challenges

AR/VR/MR Hardware and Software, components and devices, Headsets, displays, tracking systems, and input devices, AR/VR/MR software development platforms and tools, Programming languages and frameworks , Design principles for creating effective AR/VR/MR experiences

AR/VR/MR Interaction Design, Human-computer interaction (HCI), User interface design, Interaction techniques and metaphors, Navigation and locomotion in virtual environments Usability testing and evaluation

AR/VR/MR Content Creation, 3D modeling and animation, Textures, lighting, and shading in virtual environments, Sound design and audio , Creating interactive and immersive experiences, Content optimization and performance considerations

Haptics and Tactile Feedback, Introduction to haptics and tactile feedback, Haptic hardware and devices, Haptic rendering and interaction techniques, Applications of haptics in AR/VR/MR, Designing haptic feedback for realistic and engaging experiences

Text books:

1. Extended Reality (XR) - Building AR | VR | MR Projects, Packt Publishing , Parul Bansal, 2019
2. Virtual and Augmented Reality:An Educational Handbook, Zeynep Tacgin, Cambridge Scholar Publication, 2020

Introduction to IoT and Digital Twin, the basics, benefits and applications of IoT and Digital Twin in various industries, overview of Siemens portfolio for IoT and Digital Twin solutions

Siemens MindSphere Platform, Overview of Siemens MindSphere, a leading Industrial IoT platform, Understanding the architecture, features, and functionalities of MindSphere Configuring and managing MindSphere applications, Collecting and analyzing data from IoT devices using MindSphere

Siemens SIMATIC IoT Solutions, Exploring SIMATIC IoT hardware components and devices Configuring and programming SIMATIC IoT devices for data acquisition and communication Integrating SIMATIC IoT solutions with MindSphere for data visualization and analysis

Siemens Industrial Edge Computing, Understanding the concept of edge computing in Industrial IoT, Exploring Siemens Industrial Edge platform for local data processing and analytics, Configuring and deploying Industrial Edge apps for data preprocessing and edge analytics, Integrating Industrial Edge with MindSphere for seamless data flow and analysis

Digital Twin with Siemens PLM Software, Introduction to Siemens PLM (Product Lifecycle Management) software, Understanding the concept of Digital Twin in product design, simulation, and manufacturing, Using Siemens PLM software for creating and managing Digital Twins, Simulating and optimizing product performance using Digital Twin technology

Siemens TIA Portal for IoT and Digital Twin, Overview of Siemens TIA (Totally Integrated Automation) Portal, Configuring and programming Siemens PLCs (Programmable Logic Controllers) for IoT applications, Integrating TIA Portal with MindSphere and PLM software for end-to-end Digital Twin solutions, Real-world use cases and examples of IoT and Digital Twin applications using Siemens TIA Portal

Text Books:

1. Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, Apress Berkeley, CA, 2016
2. Industrial Internet of Things: Cybermanufacturing Systems, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Springer, 1st ed. 2017 edition

Introduction to Professional Development for Engineers, The need for lifelong learning in engineering, the benefits of professional development for engineers

Developing Technical Skills, The importance of staying up-to-date with technical skills, Strategies for developing technical skills, such as attending training programs, online courses, and industry conferences

Effective Communication, The importance of effective communication in the engineering profession, Strategies for improving communication skills, such as public speaking, technical writing, and interpersonal communication

Leadership and Management, the importance of leadership and management skills in the engineering profession, Strategies for developing leadership and management skills, such as taking on project management roles, attending leadership training programs, and learning about team building

Ethics and Professionalism, The importance of ethical behavior and professionalism in the engineering profession, Strategies for developing ethical and professional behavior, such as attending ethics training programs, learning about professional organizations, and networking with other professionals

Career Planning and Development, The importance of setting career goals and developing a plan to achieve them, Strategies for career planning and development, such as networking, seeking mentorship, and exploring different career paths within the engineering profession

Workplace Issues, The importance of understanding workplace issues such as workplace diversity, conflict resolution, and work-life balance, Strategies for addressing workplace issues and creating a positive work environment

Professionalism in the Digital Age, The importance of understanding digital professionalism and online communication, Strategies for managing your online presence and using social media to advance your professional goals

Text Books:

1. Strategies and Tips for Time Management, Jack Barrett

2. How to Win Friends & Influence People, Dale Carnegie

3. Start with why, Simon Sinek

PGDSFDM 411- Industrial Case Study (0-0-0-3) : Candidate has to present a live case study covering all aspects of Smart Factories and Digital Manufacturing. Presentation and report submission will be mandatory.

PGDSFDM 412- Mini Project (0-0-0-3) : Candidate has to take a live problem from industry, implement various tools of software available at CoE on Smart Factories and Digital Manufacturing to solve it. Presentation and report submission will be mandatory.