

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

**Product Design and Validation Lab**

**1. Essentials for NX Designers**

Introduction to cad - Introduction NX - Opening and closing parts and activity - User interface and working with interface and activity - Impact of datum coordinate systems - Sketching methods - Sketching constraints and activity - Sketch curve functions and activities - Sketching Exercises - Sweeping geometry and activity - Concept of layers - Creating expressions for dimensions and activity - Creating datum geometry (planes) and activity - Examining structure of model - Editing and manipulating sketches - Trimming a solid body - Swept features offset and draft - Creating and editing holes and activity - Manipulating shell features and activity - Creating pattern and mirrors in bodies - Blending and chamfering - Measuring Techniques and Synchronous modelling - Loading assemblies - Working with assemblies - Simple drawings – Project

**2. NX Basic Design**

Introduction to cad - Introduction NX - Opening and closing parts and activity - User interface and working with interface and activity - Sketching methods - Sketching constraints and activity - Sweeping geometry and activity - Creating datum geometry (planes) and activity - Creating and editing holes and activity - Blending and chamfering - Loading assemblies - Working with assembly's - Simple drawings – Project

**3. Synchronous Modeling Fundamentals**

Synchronous Modelling - Modify Face - Detail Feature - Delete Face - Reuse commands - Synchronous Modelling relationships - Dimension commands - Adaptive Shell - Edit Cross Section and Edit Section - Optimize Face - Projects: Create and edit parts using Synchronous Modelling

**4. Synchronous Modeling and Parametric Design**

Documenting design intent - Editing parametric models - Associative curve operations - Emboss geometry - Blending techniques - Interpret references - Capturing part shape variations when assembled - Design optimization - Introduction to Synchronous Modelling and Modify Face - Detail Feature, Delete Face, Reuse commands - Synchronous Modelling relationships, Dimension commands - Adaptive Shell, Edit Cross Section and Edit Section, Optimize Face

**5. Intermediate NX Design and Assemblies**

Capturing Design intent by constraining sketches - Applying advanced techniques to sketched parts - Creating freeform shaped surfaces - Capturing design intent with formulas - Duplicating features - Organizing Assy Model structure - Controlling display of parts in Assembly - Modelling parts within content of assembly - Building geometric relation between parts - Modify parts at assembly level - Creating geometric relation between parts - Modify Geometry for manufacturing process - Creating round of fillet with varying radius - Simplifying geometry - Storing Position Constraints in parts - Controlling instances in Assemblies - Defining Reusable Geometry - Revising and replacing parts - Capturing part shapes Variations when assembled - Controlling moving parts in Assembly – Project

**6. Drafting Essentials**

Part Navigator - Master model drawings and drafting standards - Drawing sheets - Drafting views - Custom views - Move, copy, and align views - Hiding geometry in drafting views - Updating drawings and drafting views - Centreline symbols – Dimensions - Notes and labels - Balloon symbols - GD&T

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ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

symbols - Surface finish, weld, and custom symbols - Section views - Editing section lines - Maintaining associativity - Detail views - View boundaries - Broken views - Break-out section views - View dependent edits - Part Attributes - Parts lists - Sectioning assembly views - Exploded views

**7. Mechanical Freeform Modeling**

Introduction to Mechanical Freeform - Curves used for creating freeform features - Edit Splines - Curve Analysis - Primary Sheets and Bodies – Transitions - Face Analysis - Working with sheets - Sheets and solids

**8. NX Sheet Metal**

Sheet Metal workflow - Establish basic part characteristics - Define the basic shape of the part - Constructing base features - Sheet Metal corners - Sheet Metal cut-outs - Sheet Metal deform features - Flat Solid and Flat Pattern - Advanced Sheet Metal commands - Analyse Formability – One step - Aerospace Sheet Metal - Working with non-sheet metal data

**9. Routing Electrical**

Wiring assembly organization - Overview of qualifying parts - Placing parts in a wiring harness assembly - Segments and paths - Converting logical data into physical data - Assigning components – Overstock - Overview

**10. Routing Mechanical**

The Routing applications and Linear paths - Routings with Heal Path - Qualifying parts - Routings with parts - Routings with stock - Managing Routing Assemblies - Runs and spools - Systems diagramming

**11. Mold Wizard**

Initializing a mold design project – Shrinkage - Mold CSYS – Workpiece - Cavity layout - Family molds - Mold tools – Partings - Mold Design Validation - Mold base - Standard Parts - Sub-insert Library - Gates and runners - Mold Cooling Tools - Electrode design - Creating pockets Drawings

**12. Large Assemblies Management**

Working in large assemblies - Manipulating assemblies - Creating representations - Create component envelopes in an assembly - Assembly Cloning - Assembly Clearance - Advanced Weight Management - Assembly Arrangements - Assembly Sequencing and Motion - Assembly Cut - Deform Part - Reference Sets - Assembly Navigator

**13. Industrial Design using NX**

Spline review and Studio Splines - Construction and Reference Geometry and Working with raster images - Curve Tools 1 - Introduction to Studio Surfaces and Shape Analysis - Workflow 1 - Studio Surfaces 2 - Additional freeform features – Blending - Curve tools 2 - Trimming and sewing - Workflow 2 and Enlarge - Shape Analysis 2 - Workflow 3 - Deviation analysis - Refit Face – Visualization

**14. Sketching Fundamentals**

Overview of cad & creating parts - Creating parts with sketch - Editing & manipulating sketches - Editing & manipulating sketches - Constraining sketches - Applying advanced technique to the sketch - Applying advanced technique to the sketch - Sketch on path overview

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**Course Syllabus**

**15. Product and Manufacturing Information**

Configuring and displaying PMI - Introduction to PMI - PMI preferences - PMI in the Part Navigator - Resize PMI - PMI annotation plane - PMI associated objects - Stacked PMI - PMI dimensioning - PMI dimensions - PMI dimension types by commands - PMI dimension concepts - Edit Dimension Associativity - Retained annotations - PMI annotation - Datum Feature Symbol - Datum Target - Feature Control Frame – Note - Balloon Note - Surface Finish - Weld Symbol - Adding and editing text - Supplemental geometry - PMI Region - Create a rectangular PMI region - PMI Centerline - PMI Center Mark - Specialized PMI - PMI notes - Coordinate Note - General Note - Activity: Create and edit specialized notes - Specific Note - Enterprise Identification - Material Specification - Part Identification - Process Specification - URL Note - Locator Designator - User Defined PMI - String Note - Number Note - Integer Note - Security markings - Government Security Information - Company Proprietary Information - Export Control - Lightweight section views - Lightweight Section View - Inherit PMI lightweight section views on a drawing - Search and reports - PMI Report - Find PMI Associated to Geometry - PMI Search - Checking PMI GD&T validity - PMI data reuse - Inherit PMI - PMI Bidirectional Edits - WAVE PMI Linker - PMI and JT files

**16. Progressive Die wizard**

Preparation - Beginning tooling projects - Blank Generator - Blank Layout - Scrap Design - Strip Layout - Die base management - Piercing & Forming Insert Design - Standard Parts Management - Progressive Die Tools - Finishing details - Drawings

**17. Motion Simulation**

Introduction to Motion Simulation – Workflow – Links – Joints - Specialized constraints and couplers - Motion drivers - Working with results - Working with assemblies - Springs and dampers - Forces and torques - Markers, Smart Points, and sensors - 2D contact - 3D contact – Bushings - Load Transfer - Flexible body analysis - PMDC electric motors

**18. Advanced Simulation Process**

Introduction to Advanced Simulation - Working with Advanced Simulation - Selecting entities - Basic meshing techniques - Boundary conditions - Boundary condition techniques - Using fields in boundary Condition – Solving - Post-processing – Reports - Geometry idealization - Geometry abstraction - Synchronous modelling - Geometry repair - Mesh collectors - Material and physical properties - Element size and mesh density - Beam modelling - Connecting meshes - Bolt modelling and pre-loads - 3D swept meshing - Manual meshing - Mesh quality

**19. Introduction to Finite Element Analysis with NX**

Introduction - Finite Element Overview - Solution Control – Nodes – Elements – Constraints – Loads - Special Cases Contact & Glue - Special Cases Welds & Bolt Preload - Linear Buckling Analysis - Model Quality - File Management Section

**20. Advanced simulation Solutions**

Introduction to advance simulation solutions and modal analysis – response simulation - thermal analysis - buckling analysis and contact and gluing - symmetry and assembly fem - nonlinear static analysis - geometry optimization and super elements - flexible body analysis and project

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

**21. Thermal and Flow analysis**

Introduction - meshing and material properties - heat transfer introduction - thermal initial and boundary conditions - thermal coupling – radiation - thermal solution options and solving - thermal postprocessing - fluid volume creation and meshing - computational fluid dynamics - flow initial conditions and boundary conditions - flow solution option and solving - flow post-processing - coupled thermal and flow - result mapping

**22. NX Response Simulation**

Single degree of freedom: free vibration - SDOF Harmonic Excitation; Damping Methods – SDOF Transient Excitation - 2-DOF Systems - Modes & Matrices in Multi- DOF Systems - Function Tools; ADF Review - Random Vibrations: Basics - Random Vibrations: Stress & Correlation - Response Spectra Defined - Response Spectrum Analysis - Shock & Vibration Specifications – Modal Sufficiency: Mode Acceleration vs. Mode Displacement; Base Excitation - Drop & Impact Test & Analysis - Restarts; Direct Response

**23. Laminate Composites**

Zone-Based Process - Ply Based Process - Modeling 3D Laminates - Solution and Post-Processing

**24. NX Nastran Advanced Non- linear**

Introduction - Contact - Nastran Keywords - Stress Stiffening Effect - Element Selection – Time Function - Arrival Time - 3D-Iterative Solver - Gasket Modeling - Metal Forming - Case study 1 - Case Study 2

**25. Sensitivity and optimization with NX**

Introduction - Overview of Design Optimization and Sensitivity - Fundamentals of Design - Optimization Modeling - Design Optimization Modeling in NX Nastran - Structural Optimization - Design Sensitivity Analysis - Dynamic Response Optimization - Other Design Optimization Topics

**26. Super Element Analysis with NX**

Introduction – Super elements Overview - Model Reduction Theory – Super element Basics in Nastran - Creating External Super elements - Part Super elements - Main Bulk Super elements - Restarts with Super elements

**27. Advanced Thermal and Flow Analysis**

Introduction - Advanced Radiation - Advanced modelling and simulation objects - Parallel processing - Duct flow networks - Axisymmetric thermal analysis - Material transformation - User subroutines - Non-Newtonian fluid - Periodic flow - Moving frames of reference - High speed flows - Turbulent flow - Mixtures and humidity - Particle tracking

**28. Advanced Dynamic Analysis with NX**

Introduction & review of fundamentals - NASTRAN OVERVIEW 1 (File Assignment, Restarts, Executive Control, Case Control) - NASTRAN OVERVIEW 2 (Bulk Data, Parameters, Nastran sets, Tips on Model Verification) - model reduction - shock and response spectrum – random response - extra points, transfer function & nolin – mfluid

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**Course Syllabus**

**29. Introduction to Dynamic Analysis with NX**

Introduction - Review of Fundamentals - Nastran Overview - Modeling Mass - Normal Mode Analysis – Damping - Transient Response Analysis - Frequency Response Analysis - Residual Vector Methods - Enforced Motion - Normal Mode with Preload

**30. DDAM analysis with NX**

Introduction - Review of Fundamentals - DDAM Process Overview - DDAM in NX Nastran - Advanced DDAM Features

**Advanced Manufacturing Lab**

**1. NX Manufacturing Fundamentals**

Introduction to cam - basic manufacturing concepts - analyzing a manufacturing – part – tools - operation navigator - parent group - cavity milling\_1 – cavity milling\_2 activities - machining with t cutters - coordinate systems – visualization - planar milling - floor and wall milling - manual drilling - fixed axis contouring engraving text - tool path information output

**2. Turning Manufacturing Process**

Define part and blank geometry - Create and retrieve tools, Face operations - Verification, Common options - Centerline operations - Rough operations – OD - Rough operations – ID - Finish operations OD and ID work - Groove operations - Teach Mode operations, Thread operations - Using multiple spindles, Mill-Turn - Vertical Turret Lathe, Merging Lathes

**3. Fixed Axis and Multi-Axis Milling**

Plunge Milling - Z-Level Milling - High speed machining - Fixed-axis contour milling - Introduction to four and five axis machining – Z level 5axis - Sequential Mill basics - Sequential Mill advanced - Variable-axis contour milling - Profiling walls with a variable tool axis - Avoid collisions by tilting the tool axis - Turbomachinery milling - Non Cutting Moves - Associative machining geometry - Hole machining - Transferring a part from one setup to another setup - Generic Motion and Probing operations - Projection Vectors - Advanced surface contouring - Multi-axis drilling (point-to-point operations) - Multi-axis drilling (point-to-point operations) - Machining with a T-Cutter - Pasting operations with reference - Area Milling cut regions

**4. NX CAM Customization**

Tool and Machining Data Libraries - Custom shop documentation - Manufacturing Wizards – Templates - Feature-based machining - Integrated simulation and verification

**5. Robcad Basics**

Introduction to Robcad - Activity & Practice – Work cell Layout - Activity & Practice - Modeling and Kinematics - Activity & Practice – Processing - Activity & Practice - Basic Simulation Techniques - Activity & Practice - Data Menu CAD Translating, More on Robot Motion - Activity & Practice

**6. Robcad Adv Modelling & Kinematics**

Advanced Modeling and Kinematics Overview - Activity & Practice - Advanced Modeling – Activity & Practice - Automatic Kinematic Creation - Activity & Practice - Kinematic Functions and More - Activity & Practice - Attribute Based Component Searching - Activity & Practice

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
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**Course Syllabus**

**7. Process Designer Basic**

Process designer interface - activity & practice - productivity tools - activity & practice - process designer environment (loaded viewer) - activity & practice - search, query, filter - activity & practice – placement - activity & practice - creating and saving engineering data - activity & practice

**8. Process Designer for General Assembly**

Introduction to Creating and Applying Variants - Activity & Practice - Introduction to Line Balancing - Use Case - Activity & Practice - Importing the Operations List - Activity & Practice - Working with Process Elements and Process Modules - Activity & Practice - Operation List Setup - Activity & Practice - Resource Allocation - Activity & Practice - Resource Cycle Time and Utilization - Activity & Practice - Creating the Line Balancing Scopes - Activity & Practice - Defining Line Balancing Constraints - Activity & Practice - Introduction to Line Balancing Criteria and Settings - Activity & Practice - Introduction to the Line Balancing Viewer - Activity & Practice - Assigning Operations to Stations (Line Balancing) - Activity & Practice - Automatic Line Balancing - Activity & Practice Line Balancing and Variants - Activity & Practice

**9. Process Designer for Body-In- White Processing**

Introduction to the Sandwich Shop Example - Activity & Practice - Power Bar Weld Searches - Activity & Practice - Mfg. Feature Introduction - Activity & Practice - Weld Spot and Search Allocation - Activity & Practice - Automatic Part Assignment - Activity & Practice - Weld Analysis and Other Weld Tools - Activity & Practice - Weld Gun Search and Allocation - Activity & Practice Other chosen - Activity & Practice - Introduction to PLPs - Activity & Practice - PLP Search and Allocation - Activity & Practice - PLP Usage Searches - Activity & Practice - PLP Manager - Activity & Practice - Allocating Weld Spots - Activity & Practice - Weld Gun Assignment - Activity & Practice - Allocating Datums - Activity & Practice

**10. Process Simulate Part Flow**

Basic Concepts - Activity & Practice - Process Simulate on Teamcenter Environment - Activity & Practice - Placement Commands - Activity & Practice - Process Simulate Analysis Tools and Scene Data - Activity & Practice - Other Selected Basic Topics - Activity & Practice - Modeling and Kinematics Overview - Activity & Practice - Modeling Basic - Activity & Practice - Kinematics Basics - Activity & Practice - Creating and Modifying Simulative Operations - Activity & Practice - Sequences of Simulative Operations in Process Simulate on eMS - Activity & Practice

**11. Process Simulate Human Simulation**

Basic Concepts - Discussion and Explanation - Process Simulate on Teamcenter Environment - Activity & Practice - Placement Commands - Activity & Practice - Process Simulate Analysis Tools and Scene Data - Activity & Practice - Other Selected Basic Topics - Activity & Practice - Modeling and Kinematics Overview - Activity & Practice - Modeling Basic - Activity & Practice - Kinematics Basics - Activity & Practice - Introduction to Process Simulate Human - Activity & Practice - Basic Human Operations - Activity & Practice - Automatic Posture Tools - Activity & Practice – Ergonomics - Activity & Practice - Assigning a Duration to Human Operations - Activity & Practice

**12. Process Simulate Basic Robotics**

Basic Concepts - Discussion and Explanation - Process Simulate on Teamcenter Environment - Activity & Practice - Placement Commands - Activity & Practice - Process Simulate Analysis Tools and Scene Data - Activity & Practice - Other Selected Basic Topics - Activity & Practice - Modeling and Kinematics

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
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**Course Syllabus**

Overview - Activity & Practice - Modeling Basic - Activity & Practice - Kinematics Basics - Activity & Practice - Other Selected Modeling and Kinematics Topics - Activity & Practice General Robotics - Activity & Practice - Spot Welding Applications - Activity & Practice - Material Handling Applications - Activity & Practice - Continuous Applications - Activity & Practice – Final Steps for Robotic Path Development - Activity & Practice

**13. Introduction to Teamcenter**

Introduction to Teamcenter - Working in My Teamcenter - Working with items in Teamcenter - Viewing and modifying object properties - Creating and managing datasets - Applying data security practices - Performing and managing searches - Navigating the relation hierarchy of an object

**14. Using to Teamcenter**

Introduction to Teamcenter - Working in My Teamcenter - Working with items in Teamcenter - Viewing and modifying object properties - Creating and managing datasets - Applying data security practices - Performing and managing searches - Working in projects - Opening and viewing product structures - Controlling assembly configuration views - Creating and managing product structures - Working with product structures - Configuring a product structure with variants - Navigating the relation hierarchy of an object - Classifying and using standard data - Viewing and working with visualization files - Initiating a workflow - Managing workflow task assignments – Managing Teamcenter data through the Microsoft Office - Using Change Manager - Creating and managing change objects - Elaborating and executing the change - Working in the Teamcenter thin client - Course summary

**15. Mockup**

Opening files - Understanding the user interface - Working with the assembly tree - Controlling part visibility - Selecting parts - Navigating around models - Setting viewing preferences - Advanced navigation modes - Part properties and attributes - Alternate hierarchies - Part appearance - True shading - Advanced part appearance - Transform parts using the Part - Transformation dialog box - Use manipulators to translate and rotate parts - Relocate parts by referencing other parts - Use Part Manipulation Mode to move parts - Exploded views – Snapshots - Measuring 3D models - Sectioning models - 3D coordinate systems - Motion file creation - Motion file playback - Recording movies - Compare 3D parts - Visual reports - Viewing CAE results - Display Product Manufacturing Information (PMI) - 3D markup - Callouts and symbols - Creating part reports – Thrust lines - 3D GD&T markups - Capturing 2D images of 3D models - Working with 2D images - Saving your work - Holding virtual conferences - Hide obscuring parts - Clipping volumes - Part groups – Filters - Measurement reports - Aligning parts - Generating part extraction paths Check clearances

**16. Integration for NX users**

Introduction to Teamcenter Integration for NX - Using Teamcenter Navigator in NX - Create new data - Revise existing data - Share data using Teamcenter Integration for NX - Import and export assemblies - Part Families - Large Assembly Management - Miscellaneous Topics

**17. Schedule Manager**

Introduction to Schedule Manager - Applying roles in Schedule Manager - Creating schedules - Creating tasks and milestones - Managing schedule resources - Maintaining schedules - Working with calendars - Adding schedule deliverables and workflow tasks - Creating notifications and subscriptions

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**Course Syllabus**

- Using nested schedules and schedule templates - Managing schedules - Configuring Schedule Manager integrations - Integrating schedules, requirements, and workflows - Schedule Manager reports

**18. Managing Requirements using Teamcenter**

Introduction to managing requirements - Creating requirements - Importing requirements from Microsoft Word - Importing requirements from Microsoft Excel - Maintaining requirements - Managing requirement structures - Allocating requirements using trace links - Managing trace links - Modifying requirements using live Excel - Modifying requirements using live Word - Working with export templates and IRDCs - Managing requirements using thin client

**19. Manufacturing Assembly Process Planning**

Teamcenter Manufacturing Process Management - Introduction to Manufacturing Concepts - Implementing Teamcenter structures for manufacturing - Engineering data management - Manufacturing part list creation (MBOM) - Manufacturing data management EBOM to MBOM - Manufacturing Process Plan Authoring Part 1 - Manufacturing Process Plan Authoring Part 2 - Manufacturing Process Plan Authoring Part 3 - Plant resource management - Using Classification - Work Instructions - Process plan approval and release - Manufacturing Assembly Part Planning

**20. Manufacturing Assembly Part Planning**

Introduction to Teamcenter Manufacturing Part Planner - Using the Part Planner Perspective - Part Planner Views - Authoring manufacturing structures - Creating manufacturing operations - Creating manufacturing operation activities - Working with physical structures – Managing manufacturing resources - Associating structures

**21. Managing Systems Design using Tc**

Introduction to Systems Engineering - Systems engineering process overview - Creating architecture structures - Importing architecture structures from Excel - Creating architecture structures using Vision - Creating low diagrams - Linking requirements and architecture structures - Applying technical measurements to a structure - Managing architecture configurations - Using workflow with Systems Engineering

**22. Installation**

Teamcenter architecture overview - Oracle server, listener, and database - MS SQL Server - Common Licensing Server - Corporate server - Two-tier rich client - Four-tier architecture overview - J2EE-based server manager and Web tier - .NET-based server manager and Web tier - Four-tier rich client installation - Installing the Business Modeler IDE - Administer the in-production system - FSC performance cache server - Dispatcher - Store and Forward - Teamcenter integrations with Microsoft Office - Teamcenter Integration for NX - Embedded visualization - Creating additional sites

**23. Application and Data Model Administration**

Business Modeler IDE fundamentals - BMIDE process and data model - Item business object – configuration - Form business object configuration - LOV (list of value) extensions - Relation business object configuration - Dataset business object configuration - Option extensions and BMIDE reports - Rule extensions



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**Course Syllabus**

**24. Customization**

Course overview - Getting started - Basic customization concepts - Topic overview - Teamcenter environment - Teamcenter ITK introduction - Command-line utility basics - Microsoft Visual Studio and Teamcenter - Teamcenter Object References - Batch program – query - Batch program – create Batch program – modify - Batch program – relate - Introducing Teamcenter Services - Using Teamcenter Services with Eclipse - Business Modeler IDE – extending the data model - Business Modeler IDE – Codeful customization setup - BMIDE Extension – workflow handlers - Custom handler – testing with a new workflow - Custom error messages – an example - Business Modeler IDE metamodel operations - Business Modeler IDE extension post action - Business Modeler IDE service operation - Summary – server programming – Hello Teamcenter revisited - Rich client – XML stylesheets - Rich client customization introduction - Eclipse RCP Introduction - Summary – rich client

**25. Advanced Workflow and Security Admin**

Introduction - Validate criteria in a workflow - Prohibit adding or removing workflow objects - Building workflows with concurrent processes - Assigning reviewers and approvers - Setting the task duration and reacting to delays - Changing multiple statuses using workflow - Tracking in-process workflows - Evaluating audit log files - Controlling data access approaches

**Test & Optimization Lab**

**1. LMS LMS Test Lab-Signature Testing & Analysis**

Introduction - Structural Testing - Impact acquisition - Spectral acquisition - Modal Analysis - Multi Run Modal Analysis - Operational Modal Analysis - Operational Deflection Shapes - Modification Prediction - Rigid Body Modes - Documentation of Project

**2. LMS Test Lab-Modal Testing and Analysis**

Introduction to Signature Testing - Typical measurement setup – Instrumentation - Digital Signal Processing – Measurement - Signature Throughput Processing – Reporting - Torsional Vibration - Measuring Torsional Vibrations

**3. 1D Simulation using Imagine Lab**

Introduction - Getting Started - Advanced Examples - Batch Runs - The Result Manager

**Automation Lab**

**1. Basics of PLC**

Automation Overview, system over view - Digital Fundamentals - Engineering Software TIA Portal - Devices & Networks - PLC Tags - Program Blocks and Program Editor - Binary Operations – Digital Operations - Data Blocks - Functions and Function Blocks - Organization Blocks - Connecting an HMI Device - Troubleshooting

**2. Basic of SCADA**

Scada overview - System Overview - Configuration Interface of engineering system - Project Creation & Basic Exercises - Basic configuration - Alarm Configuration – Practice - Data logging & Trend Configuration - Recipe Management – Practice - User administration – Practice

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

**Mechatronics Lab**

**1. Basic Mechatronics**

Mechatronics Introduction - Electrical Components - Switches, Solenoids, Potentiometer, Indicators, Reed Contacts, Photoelectric Sensors, Ultrasonic - Proximity Sensors, Capacitive Sensors - Mechanical Components: - Principles, Application - Electropneumatic Components - Signal Processing via Relays and PLC - Electrically Actuated Directional Control Valves(DCVs) - Digital Fundamentals - Programmable Logic Controller - Service Unit:- Introduction and technical Specifications - Operator Panel - Distribution station unit Introduction and technical Specifications - Testing station unit Introduction and technical Specifications - Processing station unit Introduction and technical Specifications - Buffer station, Introduction and technical Specifications

**Process Instrumentation Lab**

**1. Basic of Process Instrumentation**

Introduction and Fundamentals of Instrumentation using Process Control - Pressure Measurement Transducers – Transducers – Techniques - SITRANS PDS III and SITRANS P300 – Parameterization - Temperature Measurement – Transducers – Compensation - Product Portfolio – Applications - SITRANS TH300 with RTD – Parameterization - Level Measurement – Techniques – Product Portfolio - Applications - SITRANS Probe LU, LR 250,CLS 200 – Parameterization – Flow Measurement Techniques - Product portfolio - Applications - final control element - linear and rotary valves - Product portfolio and applications - sipart ps 2 – parameterization - communication protocols – parameterization

**2. SIMATIC PCS 7**

Introduction of PCS7 - Introduction to standard architecture of PCS 7 like ES, AS, OS-Server & OS Clients - Introduction to AS Hardware like PS, CPU & CPs. Communication of remote stations with AS - About CPU 410-5H - Configuration and Architecture of PCS7 V9.0 - Working with SIMATIC Manager in PCS 7 - Creating the Multi-project - Configuring Hardware - How to configure the PC station of the OS - Introduction to Time synchronization, Life beat monitoring, Picture tree Manager, User Administration & OS Project Editor - Introduction of Server-Client architecture - Engineering in the PCSV9.0(OS and AS) ,Working with CFC Charts and develop logic using CFC charts & optimization of the charts - Compiling, downloading & testing CFC & SFC charts - Compiling Operator Station. Creating process pictures in Graphics editor - Working with standard faceplates, Messages and Trends - Mass Data engineering tools like Process Object View, Process Tag Type & Models using Import Export assistant, Fault Diagnostics and Maintenance in PCS7

**Electrical Lab**

**1. Basics of Induction Motors**

Basic of Electrical Quantity - Basic of Induction Motor What Is Motor? Different Types Of Motor Parts Of Induction Motor - Basic of Induction Motor The Concept Of Rotating Magnetic Field The Effect Of RMF On Closed Conductor - 3-Phase Squirrel Cage Induction Motor - Energy Efficient Motor - Motor Control Starter - Product Spectrum - Characteristics And Malfunction - Motor Maintenance - Standards And Name Plate - Simocode Introduction System Components Functions - Simocode Hands On Practices On Different Applications

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

**2. Low Voltage Switch gear**

Introduction to switch gear and Fuse, General purpose relay - Overload relay - Contactor, Types of contactor, maintenance - MCB Construction, Protection in MCB - RCCB and ELCB, Advantage of RCBO, Limitations of RCCB - MPCB, Super switch - MCCB , 3VL MCCB - Power and control wiring of DOL starter, DOL starter practice session - Power and control wiring RDOL starter , RDOL starter practice session - Power and control wiring of star delta starter - Practice session on Star delta starter - Soft starter basics , Sirius soft starter - Soft starter Starting method of IM using 3RW44 - Parameterization of soft starter

**3. Electrical Basic Power Systems**

Basic of power , Generation - Transmission & Transmission line accessories – Distribution Earthing & Cable dimensioning - Different cable types , PF correction and fault calculation - Introduction to breakers - 3WT ACB, 3WL ACB - ETU and its parameterization - PAC meter, parts of PAC meter - Measured variable, Networking of the PAC meter, PAC meter configuration through Power config software - PAC meter configuration through Power config - Introduction to SIMARIS, Sub distribution board, Loads - Creating bus bar system - Type of power source, Adding couplings

**4. Basic Course on Ac - Dc Drive**

Power Electronic concepts (Diodes, Thyristors, IGBT, BJT) - Concept of Drive & Expectation from Drive Basic fundamentals of Drives - Siemens Product Portfolio ,Starters Basic concept - Starters Wiring, Hands on practices - DC motors & Concept of DC Drive in details- Features of SINAMIC DCM DC Drive & Parameterization - Types of AC motors and construction & working principle - Concept of AC Drive in details - Selection of AC Drive and its applications - Features of SINAMIC G-120 AC Drive & Parameterization - Working with STARTER Software- Inputs / Outputs, Motor potentiometer - Fixed speed set point, Speed lock Application, Skip Band Application - Basic Ramp Function generator, Shutdown functions - Energy Saving Concept in Motors

**Rapid Prototyping Lab**

**1. Rapid Prototyping Technology**

Fundamentals of Additive Manufacturing - Additive manufacturing overview - Additive manufacturing processes - Material Extrusion (FDM) - Basic manufacturing applications of Additive Manufacturing - Standards & standardization bodies

**NC Programming Lab**

**1. MILLING -Numerical control programming**

Introduction to CNC - Introduction to CNC controller - Introduction to CNC Part Programming - Introduction of standard TURNING cycles

**2. TURNING -Numerical control programming**

Introduction To CNC - Introduction to CNC controller - Introduction to CNC Part Programming - Introduction of standard TURNING cycles

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

**CNC Machine Lab**

**1. CNC TURNING- Operation and Machining**

Introduction to Turning Center - Introduction to CNC Machine Controller (828D) - Introduction to Different operating Modes - Introduction to Tools and Inserts - Introduction to Different Types of Operation - Introduction to Basic Programming - Work Offset & Tool Offset - Hands on Practice (Machining) - Introduction to Safety & Maintenance

**2. CNC MILLING- Operation and Machining**

Introduction to Turning Center - Introduction to CNC Machine Controller (828D) - Introduction to Different operating Modes - Introduction to Tools and Inserts - Introduction to Different Types of Operation - Introduction to Basic Programming - Work Offset & Tool Offset - Hands on Practice (Machining) - Introduction to Safety & Maintenance

**Robotics Lab**

**1. Basic Robotics**

Introduction of Robots - Introduction of KUKA Robots - KUKA Robot Components -1 - KUKA Robot Components -2 - Robot Safety - Robot Cell Demo - Robot Installation Phases - Robot Coordinate Systems - KUKA Smart PAD - Robot Mastering - Robot Load - Robot Jogging - Robot Tool & Base Calibration - Kuka Simpro - KRL Programming

**2. Robotics Application -Material Handling Application**

Introduction of Material Handling - Material Handling Cell Components - Material Handling Cell Demo - KUKA Simpro Material Handling Layout - KUKA Simpro Material Flow & Machine Tending Layout - KRL Logical Programming-1 - KRL Logical Programming-2 - KRL Logical Programming-3 - KRL Variables & Declaration of Variables - KRL Loop Programming - KRL Conditional Programming - Introduction of Work visual - KRL Material Handling Programming

**3. Robotic Application-MIG Welding**

Introduction of MIG Welding Processes - MIG Welding Cell Components - MIG Welding Cell Demo - KUKA Simpro MIG Welding Cell - KRL Logical Programming-1 - KRL Logical Programming-2 - KRL Logical Programming-3 - KRL Variables & Declaration of Variables - KRL Loop Programming - KRL Conditional Programming - Introduction of Work visual – Arc Tech Programming

**4. Robotic Application- Spot Welding**

Introduction of Spot-Welding Processes - Spot Welding Cell Components - Spot Welding Cell Demo - KUKA Simpro Spot Welding Cell - KRL Logical Programming-1 - KRL Logical Programming-2 - KRL Logical Programming-3 - KRL Variables & Declaration of Variables - KRL Loop Programming - KRL Conditional Programming - Introduction of Work visual - KRL Spot welding Programming

**Auto Body Repair lab**

**1. Repair and Overhauling of Chassis System (Passenger Cars)**

Introduction - Automotive Body Components - Repairing Body Components - Applying Body Filler - Sanding - Applying Primer - Applying Paint – Introduction - Automotive Body Construction - Chassis Cutting Equipment - Types of Welding - Chassis Repair Process - Wind shield Glass Replacement

**SIEMENS CENTER OF EXCELLENCE (SCoE), MIT CAMPUS,  
ANNA UNIVERSITY, CHENNAI 600044**

**Course Syllabus**

**Auto Body Paint lab**

**1. Auto Body Repair, Denting and Painting**

Introduction - Automotive Body Components - Repairing Body Components - Applying Body Filler - Sanding - Applying Primer - Applying Paint – Introduction - Automotive Body Construction - Chassis Cutting Equipment - Types of Welding - Chassis Repair Process - Wind shield Glass Replacement

**Lift Installation & Maintenance Lab**

**1. Lift Installation & Maintenance**

Introduction - Introduction to Elevators - Working of Elevators - Introduction to Escalators – Site Readiness & GAD - Installation of Lift - Troubleshooting