TSC Category	Engineering and Manufacturing Fundamentals					
TSC	Computer-aided Design					
TSC Description	Use computer-aided design software and tools to design products, components and machine parts for manufacture					
TSC Proficiency Description	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
	PRE-DES-1036-1.1	**PRE-DES-2036-1.1**	**PRE-DES-3036-1.1**	**PRE-DES-4036-1.1**		
	Produce assembly, layout and detail drawings using computer-aided design (CAD) software	Use computer-aided modelling systems to create three-dimensional (3D) solid models, assembly drawings and detailed drawings of components for manufacturing	Perform engineering analyses related to industrial equipment and machinery, using simulation and analysis tools and methods to assist in making engineering decisions	Design machine parts and assemblies, in compliance with drawing standards, using computer-aided design (CAD) systems		
Knowledge	• International and industry drawing and design practices and standards • Types of engineering tables and catalogues, electronic searches and databases relevant to CAD • Design concepts and practices, line types, line thickness and their uses • Application of library catalogues, development and use of object libraries • Types of CAD drawings, drawing and/or drafting symbols and dimensioning and projection lines • Geometrical constructions of two-dimensional (2D) and three-dimensional (3D) objects • Orthogonal projections • Sectioning methods • Fits and tolerances • Use of relevant CAD analysis • Drawing documentation	• International and industry drawing and design practices and standards • Computer-aided design (CAD) system and configuration requirements • Technical drawing conventions • Types of materials and their associated material strength and characteristics • Techniques of solid modelling • Development of sectioned models • Use of cutting planes • Use of cross-hatching • Use of pre-drawn library files and primitives to produce 3D models • Rendering techniques for 3D models	• Concepts of rigid and flexible dynamic analysis • Concepts of heat transfer analysis • Non-linear thermal and transient analyses • Concepts of rotating machinery simulation • Geometry creation and meshing • Solution setting, optimisation setup and parameters setting operations • Types and procedures of analyse and post-processing	• International and industry drawing and design practices and standards • CAD applications for machine parts • Analytical techniques for three-dimensional (3D) modelling • Fundamentals of 3D CAD solid modelling, co-ordinate systems, datum and planes, primitive features, curves, sketches and drafting in engineering • Assembly techniques • Principles and techniques of material selection • Concept and principles of geometric dimensioning and tolerancing (GD&T) • Communication of design through drafting		

Effective Date: April 2019, Version 1.1

Abilities	• Identify and clarify design objectives • Define and verify design constraints, functions and specifications, in accordance with design requirements • Verify materials, machining and/or manufacturing processes and relevant technical information, in accordance with design specifications • Plan design scopes, budgets and schedules, in accordance with design requirements • Carry out measurements required for preparation of drawings • Generate and review preliminary design drawings, in accordance with design specifications • Conduct final reviews of all drawings in accordance with organisational procedures • Document drawings and associated data • Return printed copies of all authorised drawings or CAD files after use	• Interpret international drawing conventions and standards • Clarify details of work activities to be carried out, based on given work instructions • Create library of components to enhance speed of work • Create wire mesh models, surfaces and 3D solid models in isometric view • Create assembly drawing from the 3D models • Create detail drawings for each part of the assembly • Apply rendering techniques to render solid models, according to specified criteria	• Perform pre-processing for mechanical stress simulations • Perform structural contact • Perform post-processing for mechanical stress simulations • Perform assignment of material properties, including Wohler curves (S-N curves) • Perform post-processing for results with fatigue tools for stress and strain life • Perform geometry creation and meshing • Perform board level simulation analyses • Perform meshing and non-conformal meshing • Complete solution setting, optimisation set-ups and parameters setting operations • Evaluate and conduct post-processing • Conduct computational fluid dynamics (CFD) analyses with single reference frame (SRF), multiple reference frame (MRF) and sliding mesh (SMM)	• Conceptualise machine part designs to meet functional requirements • Generate machine parts using sketches, explicit curves and primitive features • Generate CAD models for machine parts • Create top-down and bottom-up assemblies • Produce machine module assembly drawings • Produce exploded view for assemblies • Create animations for assemblies • Create models in orthographic view • Apply GD&T principles in producing drafts and models • Produce detailed drawings with dimensions for machine parts, in compliance with drawing standards • Review final designs for possible improvements, according to the machine specifications		