INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
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Item Description: Ansys Mechanical CFD Commercial Perpetual

Sr. No	Item Description	Detailed Technical Specification	Technical Compliance (Yes / No)	Additional Information (if any)
i.	ANSYS MECHANICAL ENTERPRISE	a) Capabilities in Geometric Idealization 1. Spring 2. Mass 3. Damper 4. Spar 5. Beam 6. Cable 7. Pipe/Elbow 8. Shell - Thin 9. Layered Shell - Thin (Composite) 10. Shell - Thick (Solid Shell) 11. Layered Shell - Thick (Solid Shell) 12. 2D Plane / Axisymmetric 13. 3D Solids 14. Layered 3D Solids (Composite) 15. Reinforced 16. Infinite Domain 17. 2.5 D Elements 18. Coupled Field ROM Element Technology b) Modelling Capabilities 1. Contact - Linear		

		2. Contact - Nonlinear 3. Joints 4. Seam Welds 5. Spot Welds 6. Element Birth and Death 7. Gasket Elements 8. Rezoning and Adaptive Remeshing 9. Inverse Analysis c) Types of Materials 1. Basic Linear Materials (Linear, Anisotropic, Temperature Dependent). 2. Basic Nonlinear Materials (Hyperelastic, Plasticity, Rate Independent, Isotropic, Concrete, Viscoelasticity). 3. Advanced Nonlinear Materials (Rate dependent, Anisotropic, Damage Models, Geomaterials, and Multiphysics). 4. Field Dependent 5. User Defined Material Model Formulations 6. Fracture Mechanics and Crack Growth 7. Materials Multiscale Homogenization d) Composite Materials Modelling 1. Material Definitions 2. Ply Definitions 3. Interface Layers 4. Advanced Ply-Modeling Features 5. Variable Material data 6. Solid Extrusion 7. Lay Up Mapping 8. Draping 9. Lay-Up Exchange Interfaces 10. Advanced Failure Criteria Library 11. First-ply Failure 12. Last-Ply failure 13. Delamination 14. Sandwich Modeling 15. Automation / Run Scripts 16. Short Fiber Composites		

		e) Structural Solver Capabilities 1. Linear & Nonlinear Static 2. Pre-Stress effects, Linear perturbation 3. Nonlinear Geometry 4. Buckling - Linear Eigenvalue 5. Buckling - Nonlinear Post Buckling Behaviour 6. Buckling - Nonlinear Post Buckling Behaviour – Arc Length 7. Steady State Analysis applied to a Transient Condition 8. Advanced Wave Loading 9. Implicit Time Integration f) Topology Optimization 1. Structural Optimization 2. Modal Optimization 3. Thermal Loads 4. Inertial Loads 5. Optimized Design Validation 6. Manufacturing Constraints 7. Stress constraints 8. Symmetry 9. Lattice Optimization 10. Overhang / Additive Constraints g) Multi Analysis Capabilities 1. Submodeling 2. Data Mapping 3. Multiphysics Data Mapping 4. Initial State 5. Advanced Multi-Stage 2-D to 3-D Analysis h) Vibrations analysis capabilities 1. Modal 2. Modal - Pre-Stressed 3. Modal - Damped/Unsymmetric 4. Transient - Mode-Superposition		

		5. Harmonic - Mode-Superposition 6. Harmonic – Full 7. Nonlinear Harmonic - Full 8. Spectrum 9. Random Vibration 10. Mistuning 11. Multi-Stage Cyclic Symmetry 12. Rotor dynamics i) Acoustics Capabilities 1. Modal Acoustics 2. Harmonic Acoustics 3. Transient Acoustics 4. Boundary Element Method Acoustics 5. Statistical Energy Analysis Acoustics 6. Piezoelectric Acoustics 7. Generation of Acoustic Signature from Contact Regions 8. Acoustics Element Library 9. Acoustics Material Models j) Nonlinear Multi-Body Dynamics 1. Rigid Body Mechanisms 2. Rigid Body Dynamics with CMS components for flexible bodies 3. Full Transient 4. CMS with Sub-structuring 5. Mixed Rigid - Flexible Systems k) Explicit Dynamics capabilities 1. FE (Lagrange) Solver 2. Implicit-Explicit Material States 3. Mass Scaling 4. Natural Fragmentation 5. Erosion Based on Multiple Criteria 6. Explicit Time Integration l) Durability analysis 1. Stress-Life (SN)		

		2. Strain-Life (EN) 3. Safety Factor m) Wave Hydrodynamics capabilities 1. Diffraction and Radiation 2. Frequency & Time Domain Motions Analysis 3. Moorings, Joints & Tethers 4. Internal Tanks 5. Load Transfer to Structural Analysis n) Thermal analysis capabilities 1. Steady State Thermal 2. Transient Thermal 3. Conduction 4. Convection 5. Radiation to Space 6. Radiation - Surface to Surface 7. Phase Change 8. Thermal Analysis of Layered Shells and Solids o) Multibody Dynamic Simulation 1. Tool should offer multibody dynamics simulation with rigid and flexible body integration 2. Must enable co-simulation between structural solvers and motion analysis tools 3. Required to support contact detection, force/motion transmission, and control systems 4. Real-time kinematics and dynamics response under mechanical loading conditions p) Additive Manufacturing Simulation 1. Capable of simulating powder-bed fusion and direct energy deposition processes 2. Must provide layer-by-layer thermal and structural residual stress 3. Should include support for build orientation, distortion compensation, and print failure prediction 4. Integration with support structure generation and post-print analysis for deformation and stress		

		q) Reliability Physics and Electronics Durability 1. Software must provide physics-of-failure based reliability analysis for electronic assemblies 2. Should support import of PCB layouts and material libraries for lifetime estimation under thermal, mechanical, and vibration loads 3. Predict solder fatigue, pad cratering, CAF, delamination, and mechanical fracture over lifecycle profiles r) Additional Physics 1. 1-D Thermal-Flow 2. 1-D Coupled-Field Circuits 3. 1-D Electromechanical Transducer 4. MEMS ROM 5. Piezoelectric 6. Piezoresistive 7. Electromagnetic 8. Electro-Migration 9. Diffusion-Pore-Fluid 10. Diffusion-Thermal-Electric-Magnetic 11. Multi-scale Modeling s) Optimization and Uncertainty Quantification 1. Tool must provide design space exploration, sensitivity analysis, and optimization techniques 2. Support for AI-based surrogate modelling, DOE, and robustness studies 3. Integration with Multiphysics solvers and ability to handle high-dimensional parametric models t) Optimization Analysis 1. Parameters 2. Design Point Studies 3. Correlation Analysis 4. Design of Experiments 5. Sensitivity Analysis 6. Goal Driven Optimization 7. Six Sigma Analysis u) Includes following modules		

		1. 3D CAD Modeler 2. Customization Suite 3. Support Associated Extensions 4. Journaling and Scripting 5. Command Snippet Support 6. Batch run capability 7. Read/Write 3rd Party Matrix CAE Data 8. CDB and 3rd party FE Model Import 9. Nastran Bulk File Export 10. Global/Selective Mass Scaling 11. Keyword Input 12. Splitting o fInput File into Subfiles 13. User Subroutines 14. Re-mapping 15. Transmitting boundaries 16. Dynamic Storage Allocation 17. Extensive Output Data Controls(ascii/binary) 18. Interactive Real-Time Graphics 19. Double Precision v) HPC 1. Parallel solving up to 4 cores on local PC Option 2. Parallel solving up to 4 cores over network option 3. Can be extended with Add-on HPC packs w) General Capabilities 1. Enables advanced explicit dynamics, crash, and impact simulations. 2. Supports metal forming simulations for sheet metal and stamping processes. 3. Provides end-to-end additive manufacturing simulation including print process modeling. 4. Simulates powder bed fusion processes to predict print outcomes and reduce defects. 5. Offers intuitive geometry modeling tools for simulation preparation.		

		6. Enables real-time Multiphysics simulation for structural, thermal, and fluid applications. 7. Performs rigid and flexible multibody dynamics for mechanism and motion analysis. 8. Analyzes acoustic performance for noise and vibration applications. 9. Supplies validated material property data for accurate simulation results. 10. Enables direct CAD model import using Parasolid and SAT formats. 11. Supports geometry import from SolidWorks, SolidEdge, and Autodesk platforms. 12. Supports geometry import from CATIA V5 and V6 CAD systems. 13. Enables import from Creo Parametric and Elements Direct Modelling formats. 14. Supports geometry import using the JT open CAD data format. 15. Includes built-in computational capacity for standard simulation workloads. 16. Offers scalable computing resources for large and complex simulations. 17. Provides high-performance computing support specifically for explicit and implicit solvers. 18. Allows expansion of built-in compute resources with additional core licenses. 19. Enables advanced design exploration, sensitivity analysis, and process automation. 20. Integrates AI-based tools to accelerate optimization and decision-making workflows.		
ii.	ANSYS CFD ENTERPRISE	a) CFD Solver Capabilities 1. Steady-State Flow 2. Transient Flow 3. 2D and 3D Flow 4. Compressible and Incompressible Flow 5. Customizable Material Properties 6. Non-Newtonian Viscosity 7. Real fluids models (steam, refrigerants, cryogenics, NIST data) 8. Pressure-Based Solver 9. Density-Based Solver 10. Native Multi-GPU Solver		

		11. Coupled and Segregated Solvers 12. Subsonic Flow 13. Supersonic and Hypersonic Flow 14. Turbulence – RANS models 15. Turbulence - LES/SAS/DES 16. Heat Transfer - Natural Convection, Conduction and CHT 17. Heat Transfer - Shell Conduction 18. Thermal Radiation - Participating & Transparent Media 19. ECAD Import for PCB Thermal Modeling 20. Expressions, Inc. Functions of Solution Values 21. Flow-Drive Solid Motion (6-DOF) 22. Porous Media 23. Reduced Order Model (ROM) creation 24. Dynamic/Moving-Deforming Mesh 25. Overset Mesh 26. Dynamic Solution-Adaptive Mesh Refinement 27. Fan Model 28. Virtual Blade Model 29. Inert and Massless Particle Tracking 30. Coupled Particle Tracking (with Mass) 31. Wall Film Modeling 32. Macroscopic Particle Model 33. Reacting/Combusting Particles 34. Particle Break-Up and Coalescence 35. Dense Particle Coupling (DDPM) and Granular Particle modeling 36. Wall Erosion Modeling 37. Discrete Element Model (DEM) 38. Free Surface VOF model 39. Regime change between particle and free surface (VOF <-> DPM) 40. Multiphase flow modeling 41. Complex Multiphase Regime Transitions 42. Surface Tension 43. Gas – Liquid – Solid Phase Change models, including Cavitation b) Boiling, Evaporation, Condensation, Solidification and Melting 1. Reactions Between Fluid Phases 2. Non-reacting Multicomponent Flow/Species Transport 3. Reacting Multicomponent Flow/Species Transport 4. Extensive Combustion modeling including FGM 5. Finite Rate Chemistry modeling 6. Pollutants and Soot Modeling		

		7. Ability to use Model Fuel Library Reaction Mechanisms 8. Comprehensive Surface-Kinetics 9. Flamelet Table Generation 10. Virtual cooling hole models (effusion and blade film cooling) 11. Electrochemistry modeling for Li-ion Batteries 12. Battery swelling modeling 13. Battery life modeling 14. Fuel Cell modeling 15. Multiple Stationary & Rotating Reference Frames 16. Periodic Interfaces 17. Mixing Plane/Stage Frame Change Interface 18. Sliding-Mesh/Transient Rotor-Stator Frame Change Interface 19. Pitch Change across Frame Change Interfaces 20. Aerodynamic damping (Blade Flutter) 21. Dedicated Aerodynamics workspace (CFD Aero) 22. In-flight Aircraft Icing modeling 23. Adjoint Solver for Shape Optimization 24. Parameter-driven mesh morphing and optimization 25. Parameters 26. Design Point Studies 27. Design of Experiments 28. Local Parallel Solving 29. Distributed Parallel Solving 30. Batch solving 31. Parallel Solving on Cloud launched from Desktop 32. Workbench Integration 33. Simulation Reports 34. Built-in FEA solver for Fluid-Structural and Fluid-Thermal Stress Coupling 35. Functional Mockup Unit (FMU) Coupling 36. Fluid Structure Interaction (FSI) with Structures Suite 37. Fluid Thermal Deformation with Structures Suite 38. Fluid Electro -Thermal Interaction 39. Electromechanical Thermal Management 40. Aero -optics 41. Aero-acoustics and Vibro-acoustics 42. Acoustic-Structural 43. Fluid Magnetohydrodynamics (MHD) c) Fluent Meshing Capabilities 1. Polyhedral, Poly-hexcore, Hexcore, Tet and Prism meshing 2. Mosaic-Enabled Meshing Technology 3. Task-Based Workflow - Watertight Geometries		

		4. Task-Based Workflow - Fault Tolerant Geometries 5. Parallel Mesh Generation 6. Wrap meshing 7. Rapid Octree meshing d) CFX Solver Capabilities 1. Steady-State Flow 2. Transient Flow 3. Customizable Material Properties 4. Non-Newtonian Viscosity 5. Real fluids models (steam, refrigerants, 6. cryogenics, NIST data) 7. Flow-Drive Solid Motion (6-DOF) 8. Pressure-Based Coupled Solver 9. Expressions, inc. functions of solution values 10. Dynamic/Moving-Deforming Mesh 11. Compressible and Incompressible Flow 12. Porous Media 13. Subsonic & Supersonic Flow Turbulence – RANS models 14. Turbulence - LES/SAS/DES 15. Heat Transfer - Natural Convection, Conduction and CHT 16. Thermal Radiation - Participating & Transparent Media 17. Particle Tracking (Discrete Phase Modeling) 18. Liquid Droplets (including Evaporation) 19. Reacting/Combusting Particles 20. Wall Erosion Modeling 21. Free Surface VOF model 22. Surface Tension 23. Multiphase flow modelling (Eulerian) 24. Gas – Liquid – Solid Phase Change models, including Cavitation e) Boiling, Evaporation and Condensation 1. Reactions Between Fluid Phases 2. Multicomponent Flow/Species Transport 3. Combustion Modelling 4. Acoustics / Aerodynamic noise 5. Blade film cooling model 6. Multiple Stationary & Rotating Reference Frames 7. Periodic Interfaces 8. Mixing Plane / Stage Frame Change Interface 9. Transient Rotor-Stator Frame Change Interface 10. Pitch Change Across Frame Change Interfaces 11. Aerodynamic Damping (Blade Flutter Analysis)		

		12. Transient Blade Row 13. Time Transformation 14. Fourier Transformation 15. Harmonic Analysis 16. Automated Speedline / Performance Map 17. creation 18. Local and Distributed Parallel Solving 19. Parallel Solving on Cloud launched from Desktop 20. Workbench Integration 21. Functional Mockup Unit (FMU) Coupling 22. Fluid Structure Interaction (FSI) with Mechanical 23. Fluid Thermal Deformation with Mechanical 24. Fluid Electro -Thermal Interaction 25. Electromechanical Thermal Management 26. Fluid Magnetohydrodynamics (MHD) f) TURBOGRID Meshing Capabilities 1. Automatic block-structured Hex meshing 2. Predefined block topologies for blades 3. Axial, Radial and Mixed machines 4. Splitter blades 5. Compressors, Fans, Turbines, Pumps 6. Rounded and sharp leading/trailing edges 7. Partial tip clearances 8. Automated hybrid meshing for secondary flow paths, complex tips, 9. partial tip and hub gaps (buttons), and blends 10. Automatic addition of approximate blends/fillets 11. Support for multiple input formats (CAD, NDF, profiles/curves) 12. Automatic creation of high-fidelity CAD from profile/curve input 13. Mesh refinement maintaining consistent mesh topology g) POLYFLOW Solver Capabilities 1. Viscoelasticity and Yield Stress models 2. Extrusion & Co-extrusion modeling 3. Blow Moulding modeling 4. Fiber Spinning modeling 5. Thermoforming modeling 6. Screw extruder modeling 7. 2D and 3D forming 8. Mixers and Filling modeling h) FORTE Solver Capabilities		

		1. Automatic On -the -fly Mesh Generation with Dynamic Refinement 2. Species Transport 3. Finite Rate Chemistry 4. Pollutants and Soot Modelling 5. Sparse Chemistry Solver Dynamic Cell Clustering Dynamic Adaptive Chemistry 6. Ability to Use Model Fuel Library Mechanisms 7. Flame -speed from Fuel -Component Library 8. DPIK Spark-Ignition Model 9. Internal Combustion Engine Specific Solution 10. Ge-rotor, screw compressor and scroll compressor modelling i) CHEMKIN-PRO Solver Capabilities 1. Species Transport 2. Finite Rate Chemistry 3. Multiphase Reaction 4. Pollutants and Soot Modelling 5. Sparse Chemistry Solver Dynamic Cell Clustering Dynamic Adaptive Chemistry 6. Ability to Use Model Fuel Library Mechanisms 7. Flame-speed from Fuel-Component Library 8. Internal Combustion Engine Specific Solution 9. 0-D/1-D/2-D Reactor Models and Reactor Networks 10. Plasma Reactions 11. Comprehensive Surface-Kinetics 12. Chemical and Phase Equilibrium 13. Flamelet Table Generation 14. Flame speed and Ignition Table Generation 15. Reaction Sensitivity, Uncertainty and Path Analysis 16. Surrogate Blend Formulation and Optimization 17. Mechanism Reduction 18. Reaction Workbench 19. Model Fuel Library j) FENSAP-ICE Solver Capabilities 1. Simulation of Standard Droplets, SLD and Ice Crystals 2. Inclusion of Vapor/Humidity Effects on Icing 3. Icing Environments of Appendices C, O (SLD) and D (Ice Crystals) 4. Pre-Defined Droplet Size Distributions 5. Simulation of Rime, Glaze and Mixed Icing 6. Single and Multi-Shot Icing Simulations with Mesh Deformation for Prediction of Ice		

		Accretion and Aerodynamic Performance Degradation 7. Single and Multi-Shot Icing Simulations with Automatic Re-Meshing for Prediction of Ice Accretion and Aerodynamic Performance Degradation 8. Ice Cracking 9. Ice Shedding k) POST-PROCESSING Capabilities 1. Simulation Reports 2. Turbo-specific Surface and Line locators 3. Turbo coordinate systems 4. Turbo macros and calculations 5. Multiple case file comparison 6. Point, Line, Surface, and Volume locators 7. GPU accelerated animations 8. Keyframe animations 9. Charts 10.Contours, Vectors, Streamlines, Particle Tracks 11.Expressions and quantitative calculations 12.Operating Map post-processing 13.Mesh quality metrics and calculations 14.Polyflow Results Post-processing l) HPC 1. Parallel solving upto 4 cores on local PC Option 2. Parallel solving upto 4 cores over Network option 3. Can be extended with Add-on HPC packs m) Additional Capabilities 1. Discovery Modeling 2. Discovery Modeling /SpaceClaim modeling 3. Meshing (Workbench Meshing) 4. ICEM CFD meshing. 5. Ensight 6. DesignXplorer		
iii.	Software support for one year	The TECS program is more than just the maintenance of an ANSYS license. It provides a multitude of value-added services such as: a) Access to latest software releases featuring		

		1. New capabilities and cutting-edge technology for more accurate, quick and easy to use solution 2. Resolution of Defects that may impact the project accuracy and timelines 3. Support for latest hardware platform for faster performance and increased productivity b) 24*7 access of the ANSYS Customer Portal which offers 1. Software download (Current/past releases and service packs) 2. Access to 8,000+ knowledge assets and 25,000+ pages of product documentation 3. New Feature Presentations 4. Users Conference Material/presentation 5. Product Documentation c) Access to the technical expertise and experience of our technical support team to help you resolve complex simulations and meet your simulation goals 1. Advice on how best to apply the ANSYS products to your specific application 2. Advice on project planning such as time scales, hardware requirements, etc 3. Advice on likely sources of uncertainty, model limitations, expected accuracy 4. Assessment of training needs in areas of the products with which you may be unfamiliar 5. Investigation of problems caused by user errors, software defects and limitations; and advice on solving or working around them 6. Advice on the interpretation of results 7. Assistance in resolving complex simulations and meeting your simulation goals through our extended ANSYS Customer excellence team 8. Know-how on relevant technology topics through Info webinars/Tech Days		