1. **General Specification:**

1.1 Load Flow Analysis Software to run on Microsoft Windows XP, Vista, and 7 operating systems.

1.2 The Software shall have a set of comprehensive analysis tools for the design and analysis of typical power system network comprising generation sources, power conversion sources, loads and reactive power compensation.

1.3 The Software shall handle the diverse discipline of power systems for a broad spectrum of industries in one integrated package with multiple interface views such as AC and DC networks, cable raceways, ground grid, panels, Gas Turbines, protective device coordination/selectivity, and AC and DC control system diagrams.

1.4 The Software shall allow easy creation and editing of graphical one-line diagrams (OLD), underground cable raceway systems (UGS), advanced time-current coordination and selectivity plots, as well as three-dimensional ground grid systems (GGS).

1.5 The program operation shall emulate real electrical system operation with its elements indicating energised and de-energised conditions with different colours. The Software shall incorporate innovative concepts for determining protective device coordination directly from the one-line diagram.

1.6 The Software shall enable total integration of data (electrical, logical, mechanical, and physical attributes), Looped and radial systems, Unlimited isolated sub-systems, No system connection limitations, Multiple loading conditions, Multi-level nesting of sub-systems, User access control and data validation, Asynchronous calculations, allow multiple modules to calculate simultaneously, Database transitioning reducing the risk of database loss during a power outage.

1.7 The Software shall comprise of the following modules:

   1.7.1 Base Package with Equipment Evaluation, Cable Sizing & Ampacity
   1.7.2 Load Flow / Voltage Drop Module
   1.7.3 Optimal Power Flow Module
   1.7.4 Motor Acceleration – Dynamic / Static Module
   1.7.5 Protective Device Co-ordination & Sequence of Operations Module
   1.7.6 Harmonic Analysis Module
   1.7.7 ANSI / IEC Short Circuit Analysis Module
   1.7.8 Parameter Estimation Module

2. **Base Package with Equipment Evaluation, Cable Sizing & Ampacity**

2.1 The Software shall comprise of a set of core tools to allow creation, configuration, customization and management of the system model. It shall enable to quickly build
one-line diagrams with 1000 buses connected to detailed instrumentation and grounding components.

2.2 The core tools include, the ICEA P-55-440 Cable Tray Ampacity Calculator (Stolpe Method), General power calculator, Transmission line constants, Transformer LTCs/regulator setting calculator, Motor nameplate data calculator, Motor inertia calculator, Generator nameplate data calculator, Power grid short-circuit data calculator, Cable Sizing (by verifying that the Length of the cable and the No. of Conductors/Phase have been entered), Cable Ampacity (methods to include BS 7671, ICEA P-54-440, IEC 60364-5-52, NEC), Detailed equipment reports for buses, breakers, & loads, Device Libraries.

2.3 The Base Package shall also include, Transformer MVA Sizing

2.3.1 Sizing based on the actual connected or operating load
2.3.2 Include ANSI and IEC standard types, classes, and ratings
2.3.3 Consider ambient temperature, altitude, growth and load factors, etc.

2.4 Transformer Tap Optimization

2.4.1 IEEE CSF.116 Standard
2.4.2 Optimize transformer’s tap setting or turns ratio
2.4.3 The software shall consider and transformer primary and secondary side cables.

2.5 Output Report Manager shall provide Reports for different studies

3. Load Flow / Voltage Drop Module

3.1 The software module shall be capable of providing the following functions:
- Voltage drop calculations
- Auto-Run load flow based on system changes
- Load forecasting
- Bus/transformer/cable overload warning
- Single phase load flow display
- Option to select any loading category
- Global and individual bus diversity factors
- Individual demand factors for continuous, intermittent, and spare operating conditions
- Lumped loads
- Power factor correction
- Automatically adjust transformer tap and LTC/regulator settings
- Generator governor/exciter control settings
- Load Analyzer
- Power Flow
- Demand Drop
- Automatic device evaluation
- Real & Reactive power losses
- Automatic temperature correction
4. **Optimal Power Flow Module**

4.1 The software module shall cater to the following functions:
   - Determine all control settings
   - Ensure all controls are within limits
   - Ensure all bus and branch constraints are met
   - Minimize system operating cost
   - Maximize system performance
   - Minimize real and reactive power losses and circulating reactive power
   - Minimize real power exchange with other systems (utilities or power grids)
   - Maximize voltage security index
   - Maximize branch loading security index
   - Minimize series and shunt compensation
   - Minimize load shedding
   - Minimize control movements/actions
   - Minimize generation fuel cost
   - Generator fuel cost minimization
   - Utility electricity cost minimization
   - Advanced load forecasting
   - Transmission line flow constant

5. **Motor Acceleration – Dynamic / Static Module**

5.1 The software module shall cater to the following functions:
   - Dynamic motor acceleration
   - Static motor starting
   - Multi-motor starting, stopping, and restarting in a single run
   - Group starting/acceleration of motors and loads using starting categories
   - Option to select any loading category for pre-start condition
   - Option to accelerate motors and loads by load transition (loading categories)
   - Option to use global or individual LTC time delays
   - Dynamic simulation of LTCs and regulators
   - Induction/synchronous motor/generator dynamic models
   - Single-cage, single-cage with deep-bars, double-cage, and double-cage with independent circuits
   - Start motors, loads, capacitors, (Motor Operated Valve) MOV, etc.
   - Comprehensive MOV closing and opening operation
   - MOV voltage limit check during complete stroke time
   - Comprehensive motor starting alerts with critical and marginal settings
   - Motor load modelling
   - Simulate voltage-boost effect at low frequency during starting
   - Consider various starting devices including autotransformer, resistor, reactor, and capacitor

6. **Protective Device Co-ordination & Sequence of Operations Module**

6.1 The software module shall cater to the following functions:

6.2 **Co-ordination & Selectivity**
   - AC & DC coordination
• Graphically adjustable device settings
• Extensive device library (verified & validated)
• Embedded short circuit analysis
• Embedded motor acceleration analysis
• Multi-axis time current curves
• Comprehensive plot options
• Adjustable magnifying-glass zoom view
• Time difference calculator
• Multi-function / level relays
• Device setting reports
• Automatic detection of protection zones
• Protection & coordination zone viewer

6.3 **Sequence-of-Operation**
• View device operation sequence graphically
• Device failure & backup operation
• Sequence viewer
• Normalized (shifted) curves
• Current summation
• Relay actions

(27, 49, 50, 51, 51V, 59, 67, 79, 87)

7. **Harmonic Analysis**

7.1 The software module shall cater to the following features
• Model harmonic voltage source
• Model harmonic current source
• Harmonic source defined by either spectrum or device parameters
• Generation of harmonic source based on device parameters for VFD, UPS, charger, inverter, SVC and HVDC
• Total harmonic distortions (THD) for both bus voltages and branch currents
• Total RMS value for both bus voltages and branch currents
• Total arithmetic summation value (ASUM) for both bus voltages and branch currents
• Telephone influence factors (TIF) for both bus voltages and branch currents
• I*t product for branch currents
• Built-in harmonic filters in different types
• Automatic filter sizing based on different criteria
• Verifying performance of harmonic filters
• Text report for input data, fundamental load flow results, voltage and current harmonic indices, tabulated voltage and current harmonic
• Flag violations of bus total and individual harmonic distortion limits
• Transformer K-factor rating
• Alert for VTHD, VIHD, transformer, filter, capacitor, cable

8. **ANSI / IEC Short Circuit Analysis**

8.1 The software module shall cater to the following features:
• Complete compliance with IEC Standards
• Extensive manufacturer data for fuses, LV and HV breakers
• Automatic crest and interrupting duty comparison
• Automatic peak and breaking duty comparison
• Automatic device evaluation for 3-phase, 1-phase, & panel systems
• Alert view to display critical and marginal limit violations
• 3-phase, line-line, line-ground, and line-line-ground faults
• Breaking duty as a function of breaker time delay
• Interrupting duty as a function of breaker cycle time
• Fault impedance (Z1 and Z0)
• User-definable voltage c factor for IEC analysis
• Complete grounding modeling for motors, generators and transformers
• Check making and breaking capabilities of protective devices against fault currents
• Cable temperature adjustment
• Report fault current contributions (IA and 3 I0) and voltage profiles (va, vb, and vc)
• Updates directly to device coordination
• Calculation of Tie PD current
• Load Terminal short-circuit calculation

9. **Parameter Estimation module** shall possess the following features:

• Estimate dynamic parameters of induction machines
• Include parameter variations due to speed and/or deep-bar effects
• Calculate input parameters using estimated results and report deviations

10. **Qualifying Criteria:**

10.1 The vendor shall quote proven software that has been well established and being supplied commercially for a period of two years. A reference list of the clients / industries to which the software has been supplied to shall be enclosed along with technical bid.

10.2 The Vendor shall demonstrate features / capabilities of the software at our works within 10 days after opening technical bid.

   OR

   The Vendor shall supply an evaluation / tried version of the software on CD / DVD along with the technical bid for our evaluation.

11. Training on the software shall be given in-house at our works for 2-3 days.