INDIAN INSTITUTE OF TECHNOLOGY KANPUR
DEPARTMENT OF MECHANICAL ENGINEERING

IITK/ME/SSG-02
Date: 11 Nov 2013

To,

M/S _____

_____

Subject: Purchase of Six Channel Modal Analysis and Testing System

We are interested in purchase of a Six Channel Modal Analysis and Testing System from OEMs or their sole authorized representative in India. Specifications of each subsystem are given in Table (A) to Table (D) which are enclosed with this inquiry. Following points must be noted while submitting your quotation:

1. The envelopes must be inscribed with word "Quotations".
2. Please send separate envelopes for technical and price bids.
3. All quotations must reach the Office of Mechanical Engineering by Nov 25, 2013 before 1500 hrs.
4. The quotation must be valid for 90 days.
5. The delivery period should not be more than 4 weeks.
6. Send complete details of products.
7. Payment terms: 90% on installation and 10% after submission of satisfactory report by the user to the purchase department of IIT Kanpur.
8. All prices are to be FOR IIT Kanpur.

Sincerely,

Dr. SS Gupta

Encls: Table (A): Data acquisition system

Table (B): Software for date acquisition syste,

Table (C): Modal analysis software

Table (D): Impact Hammer

SPECIFICATIONS for SIX Channel Modal Analysis and Testing System

Details of the modal analysis and testing system are given in the following four tables:

Table (A) - DATA ACQUISITION SYSTEM
Frequency Range: DC to 51.2 kHz for each of SIX channels
A/D Conversion: TWO 24 Bit
Input Voltage Range: 10 V peak and extendable range upto approximately 30 Vpeak
Dynamic Range: Typical 160 dB without attenuator
Amplitude Linearity over the entire dynamic range: Typical ± 0.01 to ± 1 dB
Frequency linearity over entire frequency range: ± 0.1 dB or better
Channel to Channel match for the entire frequency range: Typical ± 0.05 dB
Supply for Deltatron/IEPE//ICP/CCLD transducers: 4 to 5 mA from 24 V source
Signal Overload Detection for: Cable break on connected transducers, Incorrect conditioning, Detection of CCLD transducer working point fault, Common Mode Voltage Overload Detection
Dimensions: 10 inch x 6 inch x 1 inch (Approximately) for portability
Weight: Less than 1 kg.
Data communication speed: 100 MBPS
Data Transfer: 24 bit
System should have built in feature that can flatten & stretch the frequency response of transducers by upto 50%.
LAN cable operation for data transfer and power supply.
Front-panel display of ID/IP address/ status/Error conditions
Power Supply: Mains adaptor, 90-264 VAC, 47-63 Hz OR 10-32 V DC and Power Over Ethernet
System should support IEEE 1451.4 capable transducers with TEDS

Table (B) - SOFTWARE FOR DATA ACQUISITION SYSTEM
(i) The software should have provision for real-time and off line FFT analysis. (ii) The software should be able to store/display real-time time domain data/auto-spectrum/cross-spectrum
Resolution: Up to 6400 lines.
Graphic display of functions: Waterfall, Color contour, Bar, Line, Curve, Overlay (all), Multi Buffer Display, Multi-value
Options for averaging: Linear, Exponential, Max./Min. hold, +Peak/- Peak, Averaging of data (time domain, frequency response and coherence functions) for each triggered measurement. **Overlaps:** fixed values of 0%, 50 %, 66.67%, 75 % and max. (95%)
Plotting capabilities in different formats: Real, Imaginary, Magnitude, Log, dB, Phase, Nyquist, Nichols Plot, Bode Plot, Co-quad Plot, Peak picking/tracking capability, Coherence between input and output channels.
Spectral Units: Root mean square, Power spectral density, Root mean square spectral density, Energy spectral density, Peak
Windowing options: Transient, Exponential, Uniform, Hanning, Flat top, Kaiser Bessel etc.
Trigger: Single, Manual, Free-run, External. Facility for channel of trigger delay should be incorporated.
Programming: Provision should exist for writing programmes in Visual Basic® for applications embedded in the software and also to support OLE Automation/ActiveX controls, allowing the development of customized control programs.
Data export: Export of data to a file in ASCII format or to spreadsheet packages such as Microsoft® Excel. Also Universal File ASCII/Binary, SDF, should be possible.
A laptop/display unit housing the software and connected to data acquisition system should be provided. **Specification of the laptop:** 6 GB RAM, Intel I7 processor, 300 GB HDD, Windows 8 Professional OS, DVD RW, 14 inch screen, 2 or more USB 3.2 ports, 1 RS 232 port, SD card reader.

Table (C) - MODAL ANALYSIS SOFTWARE
Software should work on Windows 7 OS and above.
Inputs: FRFs from impact hammer/shaker
Geometry: **(i) Creation :** Creation of points, lines, faces and basic 3D shapes. Drawing using mouse, or through specifying coordinates (Cartesian, spherical and cylindrical coordinates). Provision to set up local coordinate systems. Automatic mesh generation for basic shapes. Easy object rotation and adjustment in 3D space of geometry and local coordinate systems. The software should provide displays of basic geometric entities which make the structure in a table or hierarchal tree. The following functions should be available in the table or the tree: Editable point coordinates, labels, lines, colours and faces labels, filtering of entities, display of text labels, hide/unhide features etc. **(ii) Visualization:** Plan View, Side View and Front View, Isometric view, Combining 2D and 3D views in different subplots, Pan, zoom and rotate options for structure. **(iii) Animation**: Single, overlaid, difference and side-by-side animation; Wire-frame, contour and points animation; Animation of non-measured DOFs using interpolation equations; AVI or any other file format to generate and save animation. **(iv) Importing/exporting geometry:** Facility to import/export geometry in DXF, UFF, STR and CSV formats
Measurement Validation Display of FRFs based on selected excitation and response DOFs on the structure, display of function data, Animation of geometry using FRFs or ODS. Software should be able to save modes in a file/table.
Modal parameter estimation: Selection of FRF for curve fitting, normal and power mode indicator functions.
Curve fitting options: Least square global partial fraction, quadrature picking, polyreference frequency and time.
Mode selection: Manual or automatic mode selection of real or complex shapes.
Stability Diagrams: Mode stability indication: Frequency Stable, Damping Stable, Vector Stable, All Stable
Modal Table: Contains the modal model in terms of natural freq, damping and mode shapes. Comprehensive documentation of modal results including: • Mode number, Mode Description, Estimation Method, Mode Complexity, Stability Level, Model Scaling, etc. • Columns with Sorting and Filtering • Damping correction: Accurate damping estimates by correcting for the effects of exponential weighting in hammer testing.
Synthesis: Comparison of measured and synthesized FRFs, Error Function, Frequency Response Assurance Criteria (FRAC)
Analysis Validation Synthesis: FRFs or Mode Indicator Functions, displacement, velocity or acceleration, mass, stiffness, both or none **MAC:** AutoMAC with animation of selected mode pairs **Correlation:** CrossMAC with animation of selected mode pairs **Reporting:** Integrated live reporting using Microsoft® Word, Excel® and PowerPoint®

Table (D) – IMPACT HAMMER
Voltage Sensitivity: 11.4 mV/N
Full scale force Range Compression: approximately 450N
Linear Error: < ± 1%
Full Scale Output Voltage: +5V
Output Impedance: <100 Ω
Power Supply: 2 to 20mA
Operating Temperature Range: -50 °C to +50 °C
Overall Length: approximately 220 mm
Effective Seismic Mass: 100 gram and head extender up to 40grams
Sensor Housing Material: Stainless steel or Titanium
Impact Tips: Rubber, plastic and metallic (aluminum/steel)
Handle Material: Stainless steel or Titanium covered with Fibreglass/polymer
Connector: Between hammer and the conditioning amplifier should be BNC with cable length ~ 5 meter

Important notes applicable to the items given in Tables – A, B, C and D:

1. **All the subsystems must be provided by a single vendor and preferably of the same make.**
2. **Complete installation, commissioning and training at IIT Kanpur will be the responsibility of the vendor.**
3. **Warranty of 3 years for hardware and supply of updates of all software for next 3 years is essential.**
4. **All the cables, connectors, manuals (on print/electronic media) must be supplied with the hardware and software.**