

**Indian Institute of Technology Delhi
Electrical Engineering Department**

30-11-2012.

Sub : NIQ for Trainer Kits for Analog , Digital DC Motor Control and Transducers.

On behalf of duly constituted purchase committee, sealed quotation are invited from the dealers for **Trainer kits for Analog , Digital DC Motor Control and Transducers** as per specifications given below..

1. Analog and Digital Motor Control Setup

1 no.

a) Servo Motor Mechanism : The setup should provide a comprehensive servo-motor mechanism that provide facilities for both speed and position control as follows:

- Analog drive amplifier,
- tacho generator - directly driven by drive motor,
- continuous rotation precision potentiometer for analog positional feedback,
- d.c. motor,
- digital drive via an on-board pulse width modulation drive circuit,
- digital speed feedback from a slotted disk,
- optoelectronic sensors,
- digital tachometer with seven-segment display of rpm,
- 3 position eddy current brake.

b) Proportional, Integral, Derivative Control Unit : This shall provide a three term controller module for use with a modular servo system. This unit shall be of open board construction. It shall have each of the three terms clearly identified on a large system mimic. Each term of the controller shall be capable of isolation by switches. The gains for the various elements shall be adjustable. The range of time constants should enable servo and process control operation. The module shall be fitted with low pass and high pass filters and shall be capable of accepting position and velocity feedback signals. All system interconnections shall be via 4mm sockets. The module shall be supplied with a student experiment manual and lecturers guide.

c) Command Potentiometer Module : This module shall provide a buffered precision potentiometer fitted with a protractor disc. It should provide command voltages in the range of $\pm 5v$ for use in control experimentation. All interconnections via 4mm sockets.

d) Set of 36 x 4mm Interconnection Leads : This set shall feature leads that comprise high quality multi strand wire with molded ends. Each lead shall be terminated with a 4mm plug at each end. Each set shall comprise assorted colors and lengths.

e) Power Supply Unit : With output voltages of 5V @ 3A, -5V @ 1A, +/- 12V @ 1A with overload protection on all rails, outputs all floating from ground.

f) Virtual control laboratory compatible with above DC motor control setup : The Virtual control laboratory should provide computer software and USB interface for use with the above DC motor control trainer and the command potentiometer board. Virtual control laboratory should perform the following functions simultaneously:

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- Monitors the reference signal from the Command potentiometer.
- Provides a proportional-integral-derivative (PID) controller with adjustable parameters.
- Generates analog/digital signals to control the DC motor module.
- Responds to analog/digital feedback signals from the DC motor module.
- Displays all control and feedback signals on the PC screen.

g) Function Generator compatible with above DC motor control setup : 3MHz Function Generators, 0.003Hz to 3MHz frequency range ,High waveform quality at all frequencies & levels, 1000:1 frequency change on each range.

Each of the modules in the system shall be interconnected using 4mm leads. The system shall be supplied complete with comprehensive student experiment text and lecturers notes.

2. Transducer And Instrumentation Trainer

1 No.

The trainer should provides a comprehensive modular training resource covering the principles of transducer and instrumentation technology. The system should comprises of a rugged, portable hardware module that features a minimum 480mm x 445mm, (19" x 17½"), PCB mounted in a steel case. All electrical and pneumatic power supplies are housed in a case. The PCB should features a system layout screen printed in yellow and white onto a green plastic panel. A comprehensive series of transducer input and output devices together with signal conditioning and instrumentation circuits is provided. These should minimum include:-

a) Input Transducers:

- Carbon track, wire wound and precision rotary potentiometers, Slide potentiometers,
- NTC thermistors, Type 'K' thermocouples, I.C. temperature sensor, Photoconductive cell, Photovoltaic cell, Phototransistor, PIN photodiode.
- Linear variable differential transformer, Linear variable capacitor, Strain gauge.
- Air flow sensor, Air pressure sensor.
- Slotted opto sensor, Reflective opto sensor, Inductive Proximity Sensor, Hall effect sensor, Precision servo potentiometer, Tachogenerator, Humidity sensor.
- Dynamic microphone, Ultrasonic receiver.

b) Output Devices

- Heater, Filament Lamp, DC Motor, Solenoid Air Valve, Ultrasonic transmitter.
- Buzzer, Loudspeaker, Relay, Solenoid, Counter/timer unit with LED display.
- Bar graph voltage indicator, Analog 10v centre-zero meter.

c) Signal Conditioning

- Buffers, Inverters, Comparator with switchable hysteresis, Amplifiers with gain and offset control.
- Current amplifier, Summing amplifier, Differential amplifier, Instrumentation amplifiers, AC amplifier, Power amplifier.
- Oscillator 40kHz, Filter 40kHz, Low pass filter with switch able time constant.
- Precision full-wave rectifier, Sample and hold circuit.
- Integrator with switch able time-constant, Differentiator with switchable time constant.
- V/F and F/V converters, V/I and I/V converters.
- Alarm oscillator with switchable latching.
- Electronic switch.

d) External Power Supplies

- -5V, +5V 1A precision supply.
- -12V, +12V 1A regulated supply.

The system should features a shaft assembly that carries a d.c. motor, tachogenerator, slotted and reflective opto sensors for incremental and absolute position. Each unit should be supplied complete with one set of teach ware. This should comprise of a student curriculum text and instructors manual. The teach ware should provides a comprehensive hands-on course of study that guides the user through the technology of transducers and instrumentation.

e) Data Acquisition of Control System for Transducer Trainer

Data acquisition of control systems should allows the student to use PC-based virtual instrumentation and data logger software to monitor and record the behavior of control systems constructed on the Transducers and instrumentation trainer and Should Support at least 30 hour curriculum manual and a virtual instrument, the Data acquisition of control systems should offer a comprehensive range of PC-linked activities that should include the following topics:

- Use of Windows™ based virtual oscilloscope and data logger software.
- Monitoring and logging of responses from the following types of control systems :
 - Temperature control.
 - Light level control.
 - Proportional motor position control.
 - Proportional-integral motor position control.
 - Proportional-derivative motor position control.
 - PID motor position control.
 - Motor speed control.


Terms and Conditions:-

1. Please submit the TECHNICAL and FINANCIAL bids in separate sealed envelopes. Mark the two envelopes clearly as “**Technical Bid**” and “**Financial Bid**”. Both the sealed envelopes should be sent in a single sealed envelope, with clearly marked as Quotation for as “**Trainer kits for Analog , Digital DC Motor Control and Transducers** “. The quote should reach the following address on or before **31/12/2012 up to 4.00PM.**

Name : Prof. I N Kar
Address : Control Lab,
Room No. II-214,
Department of Electrical Engineering,
IIT Delhi, New-Delhi – 110016 (India)

2. Please quote the price at FOB / CIF New- Delhi, inclusive of installation charges.
3. Quote should be in Indian Rupees as well as US Dollars or UKP and to be valid for at least three months.
4. Attached all technical literature and list of similar installation done in India.
5. Warranty as per OEM.
6. Mention if you can provide any technical support like training of IIT Delhi personal at IIT Delhi or in your factory and providing a technical person for operation of the machine for the initial period of 2 years. Kindly mention about this in technical bid.
7. If the quote is being submitted by the representative of the principals/manufactures themselves, a valid Agency ship/ Dealership certificate authorizing the agent to quote to IIT Delhi on behalf of the Principals should be enclosed.

8. The institute reserves the rights to accept/reject any/all quotations without assigning any reasons thereof.
9. Complete set of manuals for the operation of the equipment should be given. All circuit diagram, other mechanical and electrical schematics must be provided to main unit, sub systems and accessories.
10. Delivery within 16 weeks on receipt of PO.
11. Clearly specify the installation requirements – Such as space, power, frequency, environment (Temperature and Humidity) .
12. If the item quoted are proprietary in nature, please enclose proprietary certificate from the principals stating “certificate that ----- is proprietary item of M/s ----- and no other manufacture make these items”.
13. If the bidder is Indian agent, the agency certificate should be enclosed.
14. Please produce compliance certificate for the specification.
15. Please ensure that the Indian agent has been enlisted with the Department of Expenditure, evidence may please be attached.
16. All bank charges payable in India are to buyer’s account and the bank charges in seller’s country to seller’s account.



(Prof. I N Kar)
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