

**NATIONAL INSTITUTE OF TECHNOLOGY
KURUKSHETRA-136119**

No. EED/2019/6234 / 1356

Dated: 13/02/19

M/s Institute Website

Sub: INVITATION OF QUOTATIONS FOR TRMS-AERO(2-DOF HELICOPTER) AND ROTARY DOUBLE INVERTED PENDULUM.

1. You are invited to submit your most competitive quotation for the following goods:

Sr. No.	Brief Description & Specifications of Goods	Quantity	Delivery period
1.	TRMS-Aero(2-DOF Helicopter)	01 No.	02 weeks or up to
2.	Rotary Double Inverted Pendulum	01 No.	15.03.2019 whichever is earlier

2. Necessary literature of the goods may please be sent to facilitate to take decision.
3. Payment will be made Online through RTGS/NEFT within 30 days after receipt of material in good condition and according to specifications and installation of the same. The Bank detail for making online payment may be indicated in the quotation.
4. The supplier shall deposit Earnest Money along with the Quotation amounting to Rs. 50000 /- in shape of Accounts Payee Demand Draft/Fixed Deposit Receipt/Bankers Cheque or Bank Guarantee from any scheduled commercial Bank in favour of the Director, National Institute of Technology, Kurukshetra. The Quotations without Earnest Money shall be rejected, the EMD will remain valid for a period of 45 days beyond the final validity period of quotation.
5. Performance Security @ 5% of the total value of the equipment must be furnished in shape of Demand Draft/Fixed Deposit Receipt or Bank Guarantee from any scheduled Commercial Bank in favour of the Director, NIT Kurukshetra valid up to 60 days after the date of completion of warranty by the successful bidder.
6. The items must be supplied within delivery period or delivery period extended by the Institute on the request of the supplier on genuine grounds otherwise the penalty for delayed period @ 0.5% of the amount shall be charged for every week or part thereof and the maximum 10%. The request for extension of delivery period (if any) must be made before the last date of supply as per P.O.
7. Vide Notification No.45/2017-Union Territory Tax (Rate) and 47/2017- Integrated Tax Rate dated 14.11.2017 issued by the GoI Ministry of Finance, Department of Revenue towards exemption of GST, NIT Kurukshetra is eligible to get concessional GST (i.e. 5% in all cases) for the items which are supposed to be used in research activities of the Institute.
8. The quotation should remain valid for a period not less than 90 days from the date of submission.
9. The firm must have got GST No. printed on their quotation
10. The right of accepting or rejecting any quotation and to cancel the bidding process and reject all quotations without assigning any reason is reserved with the Institute.
11. The supplier must attach copies of two latest purchase orders (preferably from IITs/NITs) indicating the price for the equipment.
12. The due date for receipt of quotation is 26.02.2019 and will be opened on next working day at 10:00 AM. Please quote on the top of the envelope our Ref. No. and due date of opening.

Sumit
13.02.19

Prof-Incharge (Stores)

1. TRMS-Aero (2-DOF Helicopter)

Dual-rotor experiment set up with reconfigurable dynamic components for mechatronics exploration and controls.

The experiment should be reconfigurable for various aerospace systems, from 1 DOF and 2 DOF helicopter to half-quadrotor.

Computing interface technology should offer flexibility in lab configurations, using a PC, or microcontrollers, such as Arduino and Raspberry Pi.

Technical Specifications:

Device height	35.6 cm (with propeller in horizontal position)
Device length	51 cm
Device mass	3.6 kg
Yaw angle range	360°
Elevation angle range	124° ($\pm 62^\circ$ from horizontal) half-quadrotor configuration
Pitch / yaw current torque constant	57.7 Nm/A
Tri-axis gyroscope range	± 245 dps
Tri-axis accelerometer range	$\pm 2g$
Pitch encoder resolution (in quadrature)	512 counts/revolution
Yaw/travel encoder resolution (in quadrature)	1024 counts/revolution
Computer Interfacing	USB 2.0

Features:

- Compact and integrated system
- Built-in voltage amplifier with integrated current sensor
- Integrated data acquisition (DAQ) device
- Flexible computing interface for USB and SPI connections
- User-controllable tri-color LED
- Open architecture design, allowing users to design their own controller
- Fully compatible with MATLAB®/Simulink® and LabVIEW™
- Fully documented system models and parameters provided for MATLAB®/Simulink®, LabVIEW™

Special requirement

- Nonlinear modelling of the system using differential equations in MATLAB Simulink and with details in soft and hard copy of manuals
- Provision to replace the controller (provided with the set-up) with some different linear/ nonlinear controllers

Warranty: 1 year

2. Rotary Double Inverted Pendulum

Objective:

The objective of this laboratory is to design a state-feedback control system that balances a rotary double inverted pendulum and positions the rotary arm to a commanded angular position.

Students Benefits:

The Rotary Double inverted pendulum module offers the student a simple way to understand the advanced pendulum problem. The students will learn to balance two vertical rods by manipulating the angle of the base.

Students will use this module to learn practical problem-solving skills for mechanical and aerospace engineering while designing controller that maintains the pendulum in an upright position.

Technical Specification:

Nominal Motor Voltage	6 V
Motor Maximum Continuous Current (recommended)	1 A
Encoder Resolution	4096 counts/rev.
Rotary arm length (pivot to tip)	21.59 cm
Rotary arm mass	0.2570 kg
Short pendulum mass (with T-fitting)	0.097 kg
Short pendulum length (pivot to tip)	20.0 cm
Medium pendulum mass (with T-fitting)	0.127 kg
Medium pendulum length (pivot to tip)	33.65 cm

Features:

- Double pendulum comprised of a 7-inch aluminum link connected to a 12-inch link
- Double Inverted Pendulum module easily attaches to the Rotary Servo Base Unit
- High resolution encoders sense rotary arm and pendulum link angles
- Easy-connect cables and connectors
- Fully compatible with MATLAB®/Simulink® and LabVIEW™
- Fully documented system models and parameters provided for MATLAB®, Simulink®, and LabVIEW
- Open architecture design, allowing users to design their own controller

Workstation:

- Servo Motor Base unit with double inverted pendulum module
- 8 Channel Data Acquisition
- Linear Voltage Controlled power Amplifier
- Real-Time control software for Matlab/Simulink and LabVIEW
- ABET aligned curriculum with Instructor and students manual

Special requirement

- Nonlinear modelling of the system using differential equations in MATLAB Simulink and with details in soft and hard copy of manuals
- Provision to replace the controller (provided with the set-up) with some different linear/ nonlinear controllers

Warranty: 1 year