



TENDER DOCUMENTS

Mechanical Lab Equipment

NUTECH / SCM / Mechanical Lab Eqpt (PSDP) 2020 / TD-146

NATIONAL UNIVERSITY OF TECHNOLOGY

TENDER NOTICE

National University of Technology (NUTECH)

NUTECH / SCM / Civil Lab Eqpt (PSDP) 2020 / TD-144,

NUTECH / SCM / Computer Lab Eqpt (PSDP) 2020 / TD-145 &

NUTECH / SCM / Mechanical Lab Eqpt (PSDP) 2020 / TD-146

1. Sealed bids are invited from Government / FBR Registered Firms for the procurement of Lab Equipment for NUTECH on **CPT Basis**.
2. Tender documents containing terms, conditions and detailed specifications of items (including draft contract) can be downloaded from NUTECH website "<https://nutech.edu.pk/downloads/procurement/scm-tenders/> w.e.f **17 June 2020**.
3. Quotations shall be submitted as per requirement of the tender documents.
4. Bidders will be required to submit **Bank Draft / CDR** equal to **5%** of quoted value as Bid Bond in favor of National University of Technology (NUTECH).
5. Submit Rs 1500/- as Tender fee in favor of NUTECH HBL Account (**NUTECH Tendering and Contracts, 5037-7000210755**). Please attach bank receipt with technical offer. Offers will not be entertained without payment of processing fee.
6. Details for Submission & Opening of bids for each tender are as under:-

Ser	Description	Submission	Tender Opening	Completion Days
a.	Civil Lab Equipment (TD-144)	1100 hrs on 20 July 2020	1130 hrs on 20 July 2020	120 Days
b.	Computer Lab Equipment (TD-145)	1100 hrs on 21 July 2020	1130 hrs on 21 July 2020	90 Days
d.	Mechanical Lab Equipment (TD-146)	1100 hrs on 22 July 2020	1130 hrs on 22 July 2020	120 Days

Deputy Director (Supply Chain Management)

NATIONAL UNIVERSITY OF TECHNOLOGY, UPTOWN, I-12, ISLAMABAD

Tel: 0092-51-5476768, Ext: 227

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT
INVITATION TO TENDER

Tender submission time: 1100 hours, 22 July 2020

1. NUTECH desires to procure the list of item(s) / Store(s) on **CPT** basis. as per **Annexure-A**. Interested bidders are requested to send their bids through courier or deliver at NUTECH under "Single Stage – Two Envelopes" (two envelopes placed together in third envelope), marked clearly as "**Technical Offer**" and "**Commercial Offer**" respectively to the undersigned, latest by or before above mentioned due date.

2. **Conditions Governing Contracts.** The contract made as result of this IT will be in accordance with the **draft contract published on NUTECH University website** and other special conditions (Mentioned in this document) that may be added to given contract for the supply of Lab Equipment.

3. **Delivery of Tender.** The offer is to be submitted as under:-

a. **Technical Offer.** Technical Offer should contain only Annexure-A, Annexure-A-1 & Annexure B duly filled in (supported with relevant technical literature / details / catalogues etc) and receipt of tender processing fee. Copy of bid bond WITHOUT MENTIONING PRICE should be attached with technical offer. Only relevant technical details (ie literature/brochures) without mentioning the financial aspect of the offer in DUPLICATE should be enclosed in an envelope. In technical proposal, all items must have the brand names, model number, manufacturer's name, country of origin, manufacturer's warranty including parts with complete specs and brochures. Re-conditioned and re-furbished equipment shall not be acceptable. Following information will be clearly marked on the envelope:

- (1) Technical Offer
- (2) Original Performa Invoice (without price)
- (3) Tender number
- (4) Date/ time of opening

b. **Commercial Offer.** Commercial Offer will contain Annexure-C and bid bond (Dully mentioned and placed in separate envelope. The offer indicating the quoted price (IN USD only) in figures as well as in words along would be enclosed in an envelope. Following information will be clearly marked on the envelope.

- (1) Commercial Offer
- (2) Original Performa invoice with price
- (3) Tender number

c. Both the envelopes i.e. commercial offer and technical offer would be enclosed in yet another properly sealed envelope that will be marked with address of this office only. There should be clear indication that this envelope contains tender documents.

d. The tender duly sealed will be addressed to the following:-

Deputy Director (Supply Chain Management Office)
NATIONAL UNIVERSITY OF TECHNOLOGY (NUTECH)
I J P ROAD, I-12 ISLAMABAD
Tel: 0092-51-5476768, Ext: 227

4. **Date and Time for Receipt of Tender.** Sealed bids with detailed specifications should reach SCM office latest by **1100 hours on 22 July 2020**. Delay occurring in post shall not be accepted. Tenders received after the appointed / fixed time will NOT be entertained. The appointed time will, however, fall on next working day in case of closed / forced holiday.

5. **Tender opening.** The offers shall be opened 30 minutes after submission time. Commercial offers will be opened at later stage if Technical Offer is found acceptable on examination by technical authorities. Date and time for opening of commercial offer shall intimated later. Only legitimate / registered representatives of firm will be allowed to attend tender opening.

6. **Validity of Offer.** The validity period of quotations must be indicated and should be 90 days from the date of opening of financial offer.

7. **Documents.** Following information / copy of documents must be provided / attached with offer:-

- a. A copy of letter showing firm's financial capability.
- b. NTN/GST number be mentioned on the offer and copy of registration Certificate issued by Sales Tax Department, attached.
- c. Foreign supplier to provide its Registration Number issued by respective Department of Commerce authorizing export of subject stores.
- d. Annexes A, A-1, B and C and special conditions must be signed and stamped. **ATTACH ONLY RELEVANT DOCUMENTS.**
- e. Complete all Annexes as per given format. Do not use your format or letter head. Offer may be rejected if given format is not followed.
- f. OEM/principal agency agreement must be provided.

8. **Disqualification.** Offers are liable to be rejected if:-

- a. Validity of offer is not quoted as required in IT documents.
- b. Any deviation from the General/ Special / Technical Instructions.
- c. Offers are found conditional or incomplete in any respect.
- d. Copy of EM/Bid Bond & Tender processing fee (with tech offer) and original EM/Bid Bond (with fin offer) are NOT attached.
- e. Multiple rates are quoted against one item.
- f. Manufacturer's relevant brochures and technical details on major equipment assemblies are not attached in support of specifications.
- g. Offer received later than appointed / fixed date and time.
- h. Subject to restriction of export license.
- i. Offers (Commercial / technical) containing non-initialled / unauthenticated amendments / corrections / overwriting. If the validity of the agency agreement has expired. The commercial offer against FOB / CIF / C&F tender quoted in local currency.
- j. If the offer is found to be based on cartel action in connivance with other sources/participants of the tender.

9. **Earnest Money / Bid Bond.** Commercial Offer must be accompanied with a Bid Bond (CDR/Pay Order/Bank Draft) in agreement of faithful compliance of the conditions of Contract. This amount will be equivalent to 5% of the total quoted value. The Bid Bond amount submitted by the successful bidder will however be refunded on effective termination of Contract. (The Bid Bond will be forfeited in case of default by

the bidder from his commitments made through his offer). Submission of Bid Bond is mandatory; otherwise your offer will be rejected. Bid Bond will be used as performance guarantee till the delivery of stores, otherwise separate performance guarantee valued at 5 % of contract will be submitted by successful firm till stores are delivered and inspected.

10. **Return of Earnest Money/Bid Bond.**

- a. Bid Bond to the unsuccessful bidders will be returned on finalization of the lowest evaluated bidder.
- b. Bid Bond of the successful bidder/bidders will be returned on submission of Bank Guarantee/Bid bond against warranty period OR Bid bond retained for the warranty period as the case may be.

11. **Terms of Payment/ LC Charges** In CPT/FOB cases (all categories) payment will be made through letter of credit (LC). LC opening charges in Pakistan are to be borne by NUTECH. Payment will be made through irrevocable LC in favour of Manufacturer. Payment will be in USD.

12. **Bank Guarantee (BG)**. In case where equipment is backed by warranty, the BG submitted equal to 05% of FOB/FOR/CPT etc value shall remain valid for up to 60 days beyond completion of warranty period.

13. **Insurance:-** Insurance will be NUTECH's responsibility through NICL.

14. **Freight charges /Misc charges:** All charges such as packing, forwarding, local freight, loading and unloading, installation and commissioning, custom clearance, orientations, on job training or any other will be part of quoted price. Delivery till NUTECH will be firm's responsibility and all associated costs will be part of quotation as well.

15. **Warranty.** All goods /store offered would be brand new, from current year of production and will be governed as per warranty clause. The warranty period may be covered by BG as depending on the value /criticality of the tender equipment.

16. **Delivery Schedule.** Store will be delivered within **120 Days** from contract signing date.

17. **Force Majeure.** If non-compliance with the period of delivery or services can be proved to be due to Force Majeure, such as but not limited to mobilization, war,

riot, strike, lockout or the occurrence of unforeseen events, the period shall be reasonably extended.

18. **Subletting** Suppliers are not allowed to sublet wholly or part of the contract to any other firm /company without prior permission by NUTECH. Firm found in breach of the clause will be dealt with as per purchaser's right and discretion.

19. **Arbitration.** The dispute shall referred for adjudication to a board comprising of Pro-Rector NUTECH as Chairman and two arbitrators, one to be nominated by each party. The arbitration proceeding shall be held in Pakistan under Pakistan Law. The venue of arbitration shall be the place from which the contract is issued or such other place as the purchaser at his discretion may determine. Arbitration award so given will be firm and final.

20. **Export License/Permit /End User Cert.** It shall be the responsibility of the Supplier to obtain from the Government concerned all permits and export licenses, etc required to enable each consignment to be shipped immediately as per the delivery schedule. In case the supplier fails to arrange export license within 30 days of signing the contract the purchaser reserves the right to cancel the contract on the risk and expense of the supplier without prior notice. The purchaser will provide End User Certificate for acquisition of export license to the supplier (format to be provided by the supplier for respective country within 10 day of signing of the contract).

21. **Technical Specification:** The supplier will provide OEM certificate, quality certificate /inspection document to the purchaser confirming the quality of the product being supplied under this contract .Store must bear the manufacturer's identification marking /monogram.

22. **Inspection /Testing of Store:** Inspection testing will be carried out at NUTECH by the concerned inspection team as detailed by the respective department in accordance with the laid down Acceptance Criteria. (Acceptance Test Procedure (ATPs)/Drawing /Test standard and specification). **The supplier will provide ATPs with technical offer.** Mutually agreed/approved ATPs will form part of contract to govern the inspection of store subsequently.

23. **Requirement of Samples.** The requirement of tender sample will be included in the case if required for evaluation by technical authorities'. Beside this advance sample if required will be also made part of the IT as well as the contract.

24. **Change In Specification / Mfr / Model.** No alternation marked/brand and quality of store will be entertained after the tender have been opened.

25. **Checking of Store at Consignee End.** All stores will be checked at Consignee's end in the presence of the supplier's representative. If for some reason, the supplier decides not to nominate his representative for such checking, an advance written notice to this effect will be given by the supplier to the consignee prior to immediately on shipment of store. In such an event the supplier will clearly undertake that decision of consignee with regard to quantities and description of consignment will be taken as final and discrepancy found will be accordingly made up by supplier. In all other cases the consignee will inform the supplier about arrival of consignment immediately on receipt of store through registered email/letter and telephone. If no response from the supplier is received within 15 days from initiation letter the consignee will have the right to proceed with the checking without supplier's representative .Consignee's report on checking of the stores will be binding on the supplier in such cases.

26. **Packing /Marking.** The supplier shall be responsible for proper packing of the Store in standard export packing worthy of transportation by sea /air /road rail so as to ensure their content being free from lose or damages due to faulty packing on arrival at the ultimate destination. Packing of stores will be done at the expenses of the supplier. All packing cases, containers and other packing material shall become the property of the NUTECH on receipt. Any loss occurred /demurrage paid due to wrong marking will be made good by the supplier

27. **Original Performa Invoice:** Original Performa invoice must have following components incorporated:-

- a. HS Code
- b. Incoterm
- c. Payment Terms
- d. Origin of good
- e. Port of shipment

- f. Address of OEM
- g. Seller acceptance (on Performa Invoice)
- h. Invoice Date
- i. Latest date of shipment
- j. Seller complete bank detail

Note: Performa Invoice in the name of NUTECH in case of FOB cases & in the name of local partner in case of FOR cases.

28. **General Instructions:** Following must be noted:-

- a. The firm should provide point to point acceptance of each clause of IT and special instructions attached with IT.
- b. Firm will render a certificate with technical offer that firm is neither defaulter nor blacklisted by any Government / semi Government organization directly or indirectly.
- c. Rates should be quoted on Free Delivery basis at NUTECH Islamabad.
- d. **2 years** warranty against **5% Bank Guarantee** of the store value will be required from the successful bidders from the date of commissioning as performance bond.
- e. The stipulated delivery period should be strictly adhered to. Any anticipated delay that is beyond the control of Seller will be informed (in writing) well in advance of the expiry of the due date of the activity along with reasons thereof, requesting for the grant of extension in delivery period. If the Seller fails to do so, or the Buyer is not convinced with the rationale provided by the Seller, Liquidated Damages up to/at 2% per month or part thereof, will be imposed. However, the maximum limit of the Liquidated Damages will not exceed 10% of the delayed store value.
- f. If even after applicability of 10% LD, the Seller fails to deliver the required stores, the Buyer will be at liberty to Cancel the contract, and /or procure the stores from an alternate source, on the Seller's "Risk & Cost/Expense". In that case, the Seller will be bound to make payment to the new source through NUTECH. The purchaser's decision under this clause shall NOT be subjected to arbitration.
- g. NUTECH reserves the right to cancel the Contract without assigning

any reason whatsoever during its currency / execution / after placement, if the firm is found to be involved in any dubious activity, litigation, lacking to meet contractual obligations with the purchaser or is blacklisted with any other Public procurement agency. No claims / loss / damage of whatsoever nature shall be entertained and NUTECH's decision in this regard will be final / binding on the Seller.

- h. An appropriate amount may be paid for mobilization against Bank Guarantee/CDR/Demand Draft/Pay Order.
- i. Firms with previous pending/outstanding projects/business with NUTECH may not be considered for award of this tender.

Deputy Director
Supply Chain Management Office

Annex-A**Technical Specifications****NUTECH / SCM Mechanical Lab Eqpt (PSDP) 2020 / TD-146**

Ser	Part No	Items	Description	A/U	Country of Origin	Qty Req	Bidder Compliance		
							Yes	No	Alternate
1.		Determination of Gear Efficiency	<ul style="list-style-type: none"> • Three-phase AC motor with variable speed of, power output: 0,20kW, speed: 0...2500 revolutions min-1 • Magnetic particle brake, rated braking torque at exciting current 0...0.2A: 0...8Nm • Two-stage spur gear, transmission ratio should be minimum of 13,5 torque: min, 23.4Nm • Worm gear with minimum of transmission ratio: 15, torque: 10Nm, worm: z=2, worm gear: z=40 • Measuring ranges, speed: 0...3000min-1, force: 0...100N • Unit should be compatible with the following electric combinations 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase • Efficiency of the unit should be displayed in digital form <p><u>Experimental Capabilities</u> Determination of the mechanical efficiency of gears by comparing the mechanical driving and braking power for a) Spur gears b) Worm gears c) Helical gears</p> <ul style="list-style-type: none"> • Determine the speed ratios over gears 	No	Europe / USA	1			

			teeth ratios <ul style="list-style-type: none"> • Determine the torque variations over the applied loading conditions • Determine of the backlash over a) spur gears b) helical gears c) worm gears • Predictions of transmission ratios • Predictions of torque transmissions 						
2.		Torsional Oscillations Apparatus with DAQ system	<ul style="list-style-type: none"> • Unit for studying torsion in shafts with rotation motion, torsional rigidity and the behaviour of a torsional vibration system with one, two or three discs of inertia • Bench-top unit with adjustable legs • Anodized aluminium frame and panels made of painted steel. • Main metallic elements made of stainless steel. • Three-phase motor of 0.5 kW (Approximately) • Vibrational Exciters • Velocity measuring sensors • Optical sensors to visualize the loops of oscillations • Torsion bar (Approximate dimensions) with clamping system for securing the bar to the torsional system <ul style="list-style-type: none"> ▪ Diameter: 4 to 6 mm. ▪ Length: 1000-1500 mm. • Polar moment of inertia: $I_p = 1.27 \cdot 10^{-10} \text{ m}^4$. (Approximate) • Angle of rotation selector, with possibility of selecting among three different angles • At least three discs of inertia: • Disc 1 (2 units): diameter of 150 mm 	No	Europe / USA	1			

			<p>and mass of 2.6 kg. Moment of inertia $I = 0.00731 \text{ kg}\cdot\text{m}^2$. (Approximate)</p> <ul style="list-style-type: none"> • Disc 2: diameter of 240 mm and mass of 4.9 kg. Moment of inertia $I = 0.06679 \text{ kg}\cdot\text{m}^2$ (Approximate) • Four angle of rotation sensors, resolution: 0.067 V/degree, effective measuring range of $\pm 45^\circ$. • Graduated rule of 1300 mm. • Advanced Real-Time SCADA software with Open Control, Multicontrol and Real-Time Control. • National Instruments Data Acquisition board (Minimum 230 KS/s, kilo samples per second) • Safety features utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software) • Set of compatible Weights and hangers (Like) <ul style="list-style-type: none"> • 6 weights of 200 g. (0.44 pounds) • 6 weights of 100 g. (0.22 pounds) • 2 weights of 50 g. (0.11 pounds) • 2 weights of 20 g. (0.044 pounds) • 2 weights of 10 g. (0.022 pounds) • 1 support hook of 100 g. (0.22 pounds) • Adjustable bars lengths to generate the oscillations 						
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		<ul style="list-style-type: none"> • Bars supportable from different points to make the visual loops • Oscillation amplitude measuring sensors • A real industrial simulation system through SCADA • Control interface box • Visualization of all the sensors values. <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Study of the behavior of the torsional vibrations. • Study of the oscillation frequency. • Study of torsional vibrations of a system subjected to free torsion. • Study of torsional vibrations of a system subjected to forced torsion. • Calculation of the damping coefficient of a system subjected to torsional vibration. • Study of the resonance and phase shift in a system around its operation in the natural frequency • Study of the behavior of the torsional vibrations of a system with two and three discs of inertia. • Determination of the torsional rigidity of a bar subjected to torsion • Determination of the modulus of rigidity of a torsion bar 								
3.		Multi-channel Measurement Amplifier with DAQ	A 16-channel strain display instrument that connects to industry-standard strain gauges.	No	Europe / USA	1				

			<ul style="list-style-type: none"> • Fully programmable display to match the strain gauges and their bridge connections • Two dynamic outputs to connect to suitable instruments, such as an oscilloscope or a chart recorder for measurement of transient strains • Direct connections for half and full strain bridge connections, with internal 'make-up' resistors • Fully programmable to match most types of strain gauges and connections • Range $\pm 10,000 \mu\epsilon$, dynamic strain range $\pm 2000 \mu\epsilon$. • Dynamic strain output ranges <ul style="list-style-type: none"> • 200 $\mu\epsilon$/Volt with full bridge connection • 400 $\mu\epsilon$/Volt with half bridge connection • 800 $\mu\epsilon$/Volt with quarter bridge connection • DAQ System • Strain Gauge Kit should be supplied along with following strain gauges <ul style="list-style-type: none"> • 10x type PFL-20-11 polyester foil strain gauges. Length 20 mm, rated 120 Ohms ± 0.3 Ohm, Gauge Factor 2.13 • 10x type FLA-10-11 alloy foil strain gauges. Length 10 mm, rated 120 Ohms ± 0.3 Ohm, Gauge Factor 2.10 • 10x type FLA-6-11 alloy foil strain gauges. Length 6 mm, rated 120 Ohms ± 0.3 Ohm, Gauge Factor 2.12 						
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			<ul style="list-style-type: none"> • Required solvents, cleaners, neutralizing cleaners, adhesive rubber strips, sufficient quantity of coloured wires, terminal tags, soldering iron and solders, adhesives etc 						
4.		Hydraulics and Electrohydraulic Trainer with DAQ system	<ul style="list-style-type: none"> • Trolley (Aluminium Channel) with frame & caster wheels with Brake • A modular unit consisting of variety of optional kits and elements to configure the desired Hydraulic and Electro-Hydraulic circuit • Hydraulic tank with minimum of 8 Litre capacity, • Oil cleanliness: With suction filter and return line filter • Hydraulics kit containing components to understand the fundamentals and advanced concepts of the hydraulic circuits <ul style="list-style-type: none"> • Pressure control valves and Pressure limiting valve for Pressure regulation from 5 to 50 bars • Flow control valves: <ul style="list-style-type: none"> • Shut-off valve. • Adjustable flow control valve: <ul style="list-style-type: none"> • Knob to regulate the flow.. • Manual distribution valves: • Hydraulic actuators: <ul style="list-style-type: none"> • Double effect cylinder made of stainless steel. Diameter: 40 mm and Stroke of 200 mm. • Connection parts and accessories: <ul style="list-style-type: none"> • Set of 5 hoses with quick-fit connectors: • 0.6 m hose (2 units). 	No	Europe / USA	1			

			<ul style="list-style-type: none"> • 1 m hose (2 units). • 2 m hose. • Cross-shaped manifold with manometer with range from 0 to 100 bar with damping • Tank to perform volumetric measures with minimum Capacity of 3 litres and overflow protection • Digital tachometer with built in laser pointer and high visible digital 5 digit, 13 mm, LCD display for fast and accurate Non-contact RPM and surface speed measurements of rotating objects • Electro-Hydraulics kit containing components to understand the fundamentals and advanced concepts of the electro-hydraulic circuits. <ul style="list-style-type: none"> • Pressure control valves and Pressure limiting valve for Pressure regulation from 5 to 50 bars • Flow control valves: <ul style="list-style-type: none"> • Shut-off valve. • Adjustable flow control valve with pressure compensation • Check valve for flow control with bypass. • Hydraulic solenoid valves: <ul style="list-style-type: none"> • Bistable 4/2 solenoid valve: <ul style="list-style-type: none"> ○ Electric activation. ○ Maximum flow: 60 l/min. ○ Maximum pressure: 350 bar. ○ LED indicator. • 4/3 solenoid valve with P-T centre 						
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			<p>linked with Electric activation, Tandem centre, P-T linked, Spring return, with Maximum flow: 60 l/min Maximum pressure: 350 bar</p> <ul style="list-style-type: none"> • 4/2 solenoid valve with spring return (2 units) with Electric activation, Spring return, Maximum flow: 60 l/min and Maximum pressure: 350 bar. • 4/3 solenoid valve with closed centre (2 units) with Electric activation, Closed centre, Spring centred, Maximum flow: 60 l/min and Maximum pressure: 350 bar. • Hydraulic actuators like Double effect cylinder with Diameter: 40 mm, Stroke of 200 mm. • Should have Sensors like Pressure switch, Inductive proximity sensor, two Reed effect proximity sensor, Limit switch • Hydraulic Actuators kit for learning the concepts behind the most common hydraulic actuators as hydraulic motors, hydraulic cylinders, etc • Pressure control valves, Flow control valves, Manual distribution valves, Double control valve with joystick, Hydraulic actuators, required sensors and connections • Kit for Measurement and Proportional Control, configured to perform the analogue signal and the proportional control over the hydraulic actuators to implement a PID control from the computer. <ul style="list-style-type: none"> • Control Interface box, PID controller, 						
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			<ul style="list-style-type: none"> ○ P controller: K_c: -10 to +10. ○ I controller: T_i: 0 to 100 s. ○ D controller: T_d: 0 to 100 s. <p>Sample time: 0.1 to 100 ms.</p> <ul style="list-style-type: none"> • Electric comparator, 4 analogue inputs, and 4 analogue outputs • SCADA system with PCI Express Data acquisition board (National Instruments) with <ul style="list-style-type: none"> • Analog input for Number of channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536 • Sampling rate up to: 250 KS/s (kilo samples per second) • Analog output Number of channels=2. Resolution=16 bits, 1 in 65536. Maximum output rate up to: 900 KS/s • Digital Input / Output Number of channels=24 • Pressure control valves, Flow control valves, Hydraulic Solenoid Valves, Hydraulic actuators, required sensors and connections • Hydrostatic Steering System kit designed to teach the most common components of the steering system with Distribution valves containing, Maximum flow: 5 l/min, Maximum pressure: 350 bar • Hydraulic and Electro-Hydraulic troubleshooting kit containing Pressure 						
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			<p>control valves, Flow control valves, Distribution valves, Hydraulic actuators, required sensors and connections</p> <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Hydraulic Pump Troubleshooting • Flow Measurements • Hydraulic actuators troubleshooting's • Cylinder cushions and boosts • Motor troubleshooting • Hydraulic directional control valve troubleshooting • Hydraulic system troubleshooting • System level troubleshooting • Machine sequence troubleshooting • Machine performance troubleshooting • Hydraulic Filter Maintenance and calibration unit • Fitting and seals systems in a hydraulic unit • Flushing of fluid in a hydraulic systems • Adding of hydraulic fluid in a system • Tubing and component installation 						
5.		Pneumatics Trainer with DAQ system	<ul style="list-style-type: none"> • Multi way valves of type pressure, shut-off and flow control valves • electric limit switch, • proximity switches, • solenoid valves, • signal boards • PLC with programming software • integrated power supply unit to supply the electro pneumatics and the PLC • distributor block for simultaneous use 	No	Europe / USA	1			

			<p>of both panels, hoses, cables,</p> <ul style="list-style-type: none"> • Air Compressor (Low noise 40 d B (A) / 1 m) Suction capacity: 50 l / min and Pressure: 8 bars • Air Cylinders with Adjustable Cushions • Grooved plate • Membrane dryer, a reliable, effective and cost-efficient alternative for compressed air drying. • Measuring device for setting the end position damping with measuring range damping max. 64 mm, Minimum piston speed 0.2 m/sec and display LED 3-colour Interfaces • Three-Position Pneu-Turn Rotary Actuators • Micro-Line 3-Way Air Switches • Original Line Three-Position Cylinder • Air Pilot Valve • Solenoid Valve • Dual Air Manifold • Power Supply • PIV-Pneumatic Isolation Valves • Push Button valve • Toggle Valve • Connecting Pipe roll • Elbow connector pack • Straight connector pack • Manifold connector pack • Pipe Cutter • Bracket for rod less cylinder • T-connectors <p><u>Experimental Capabilities</u></p>						
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			<ul style="list-style-type: none"> • Pneumatics power systems • Pneumatics circuits • Pressure and flow of air using pneumatics based units • Speed control circuits • Directional control valves • Demonstration of Air logic based system • Pneumatics maintenance • Schematics • Air flow and resistance • Flow control valves • Demonstration of cam valves for pneumatics control systems 						
6.		Weights and DAQ system for Cam and Follower Apparatus	<ul style="list-style-type: none"> • DAQ System for capturing data and show live traces (on a computer screen) of the follower movement – even at bounce • Set of weights and hooks like <ul style="list-style-type: none"> • 6 weights of 200 g. (0.44 pounds) • 6 weights of 100 g. (0.22 pounds) • 2 weights of 50 g. (0.11 pounds) • 2 weights of 20 g. (0.044 pounds) • 2 weights of 10 g. (0.022 pounds) • 1 support hook of 100 g. (0.22 pounds) • Compatible with model “MEX-Cam and Follower Mechanism” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Demonstration and Measurement of Cam bounce speeds for different cam and follower combinations 	No	Europe / USA	1			

			<ul style="list-style-type: none"> • Demonstration of the action of a plate cam and an eccentric with different geometrical profiles and various types of followers • Demonstration of the conversion of the circular motion of a plate cam into the angular motion of a roller follower. • Demonstration of the conversion of the circular motion of a plate cam into the linear motion of a flat follower. • Study of the influence of the roller follower's diameter in the conversion of the circular motion of the plate cam into the angular motion of a roller follower. • Determination and graphical illustration of the relationship between the displacement of the follower and the angular displacement of the cam for several types of cams and followers. • Measurement of the force needed to be overcome in order to rotate a cam at different angular positions. 						
7.		Simple Gear System with DAQ System	<ul style="list-style-type: none"> • Self-contained bench-mounted base unit for dynamic performance tests – including a dual-purpose simple and compound gear drive units • Optional drive units, including belt drives and a chain drive for comparative tests of different drive types • A variable-speed, High stability, low-voltage drive motor for providing the shaft 	No	Europe / USA	1			

		<p>input turning force.</p> <ul style="list-style-type: none"> • Power output approximately 15 W at 1000 RPM • A hysteresis effect dynamometer brake, constant dissipation for providing a constant torque at any given speed • Motor RPM measuring system with range of 3000 rev per min • Torque Measuring via a load arm bearing onto an electronic load cell • Display system for Motor Speed, Torque and Power • Drive units for working with the Geared Systems Base Unit for dynamic tests on performance, allowing comparison with the gear drive • Three shafts, with one gear on shafts 1 and 3, and two on shaft 3. <ul style="list-style-type: none"> ○ Shaft 1 has a gear of 80 teeth. ○ Shaft 2 has a gear of 60 teeth and a gear of 120 teeth. ○ Shaft 3 has a gear of 120 teeth • Flywheel should be a single wheel of radius 48 mm including 5x Weight Hangers, 150x 10 g masses, 15x 1 g masses <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of different geared systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies 						
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			<p>of gear trains</p> <ul style="list-style-type: none"> • Calculation of Mechanical advantage, velocity ratio and dynamic efficiencies of drive units toothed belt drive, round belt, chain drive and helical gear • Chain and belt drive tension, including different methods of application • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of geared drive systems by calculated and experimental methods 						
	7a	Toothed Belt Drive Model	<ul style="list-style-type: none"> • Flexible tooth belt with adjustable tension • Driver with min 25 teeth • Follower with min 40 teeth • Tools needed to fit the drive units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture A” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of toothed belt drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Toothed belt drive tension, including different methods of application 	No	USA/ Europe	1			

			<ul style="list-style-type: none"> • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of belt drive systems by calculated and experimental methods 						
	7b	Round Belt Drive Model	<ul style="list-style-type: none"> • Flexible, round cross sectioned belt with adjustable tension • Driver min dia: 35mm • Follower min dia: 55mm • Tools needed to fit the drive units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture B” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of round belt drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Round belt drive tension, including different methods of application • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of round belt drive systems by calculated and experimental methods 	No	USA/ Europe	1			
	7c	Chain Drive Model	<ul style="list-style-type: none"> • Roller chain with adjustable tension • Driver with min teeth: 15 • Follower with min teeth: 25 	No	USA/ Europe	1			

		<ul style="list-style-type: none"> • tools needed to fit the drive • units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture C” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of chain drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model <ul style="list-style-type: none"> • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of chain drive systems by calculated and experimental methods 						
7d	Helical Gear Drive Model	<ul style="list-style-type: none"> • Driver with min teeth: 70 • Follower with min teeth: 110 • tools needed to fit the drive units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture D” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of helical gear drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Comparison of and calculation of Mass 	No	USA/ Europe	1			

			<p>moment of inertia of a flywheel from calculated and experimental values</p> <ul style="list-style-type: none"> • Comparison and Calculation of Mass moment of inertia of helical gear drive systems by calculated and experimental methods 						
	7e	Acceleration and Static Test Stand	<ul style="list-style-type: none"> • Stand should an option to connect with data acquisition system • Able to measure the angular acceleration and static efficiency of the attached system i.e. flywheel, compounded gear system, belt drive system, chain drive system • Masses to apply load on attached unit to stand. Limit of each weight should be of minimum 5 grams, • The test stand should include sets of weights to apply turning forces to the shaft of a flywheel or from the gear drive. • A sensor which automatically calculates angular acceleration. • A slot to the front of the test stand should hold a tray to store weights and other loose items • Picture attached as “Picture E” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Demonstration and calculations of static test efficiency of geared systems • Analysis of the static tests and dynamic tests of geared models, chain drive models and belt driven models 	No	Europe / USA	1			

			<ul style="list-style-type: none">• Mechanical Advantage, Velocity Ratio and static efficiencies of gear drives• Mass moment of inertia of a flywheel by experiment and calculation• Mass moment of inertia of geared drive systems by experiment and calculation						
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Firm Name: _____
Signature: _____
Name: _____
Designation: _____

Annex A-1**Special Instructions**

Description	Bidder			Tech Scrutiny to be done by User		
	Yes	No	Alternate Offer	Accepted	Rejected	Reasons of Rejection
Environment Conditions (a) Temperature range: 05°C to +40°C (b) Relative humidity: 0-70% non-condensing						
Warranty period Two years from the date of commissioning.						
Training Notes Supplier will provide a set of handouts for training on operation and maintenance of the equipment						
Publications Supplier is to provide hard and soft copies (CD) of following manuals. (a) Operational / Maintenance manual: - Qty 01 with Equipment and additional Qty 02 for record purposes and should consist of following sections:- (1) Equipment Description /Operation:- (a)Specifications (b)Description (c)Operation (2) Servicing:- (a)Maintenance Schedule (b)Adjustment / test (c)Removal / Installation procedure (d)Tools Required (3) Trouble shooting guide (4) Cleaning requirements (b) Full parts description along with detailed diagrams (exploded view). (c) Experimental manuals which must contain the list and procedure of the						

experiments that equipment can perform.						
<p>Spares / Technical Support</p> <p>(a) Supplier to have in-country spares / technical support and ensure spares and technical support / assistance for next 10 years</p> <p>(b) Comprehensive list of spares required for scheduled maintenance of Equipment is to be provided</p> <p>(c) Any software provided must have its license</p> <p>(d) Software upgrade support must be provided free of cost for 10 x years with renewed license at every upgrade</p> <p>(e) Supplier must also provide calibration service for at least 5 years after commissioning</p>						
<p>Additional Spare / Replaceable parts.</p> <p>(a) Replaceable spare / parts during scheduled inspections are to be identified and provided as per requirement along with equipment sufficient to cater five years consumption.</p> <p>(b) All specialized / standard tools required for inspection / repair / servicing must be supplied along with equipment.</p>						
<p>Physical Inspection Criteria: 100% physical inspection of store will be carried out before commissioning of the equipment for following details:-</p> <p>(a) For physical damage, scratches and deformity.</p> <p>(b) Accessories /components as per contractual specifications.</p> <p>(c) Technical Manuals (Operation manual, user guide).</p> <p>(d) Quality certificate and calibration certificate by the OEM</p> <p>(e) OEM certificate and verifiable documents by the supplier that store has been procured from certified source and is factory new and from latest production.</p> <p>(f) Brand name and country of origin.</p>						

<p>Commissioning (a) Commissioning by OEM rep at his own cost and risk at designated place at NUTECH. (b) Any special requirement for installation, operation and commissioning must be specified in the offer by the supplier.</p>						
<p>Training 01 week OEM operational/ maintenance training at NUTECH</p>						
<p>Improvement and Safety Measures Any improvement and safety measures suggested by NUTECH during commissioning are to be resolved by the supplier / manufacturer at no extra cost.</p>						
<p>Liability of Supplier (a) OEM certificate of authorized dealership Supplier is to provide original OEM certificate of subject equipment bought directly from the manufacturer and being an authorized dealer. (b) In case the equipment supplied is not compatible with specifications, the supplier will be obliged to call his representatives at his own cost for consultation and corrective action</p>						
<p>Special Notes (a) Additional requirements for the maintenance of equipment (if any) must be intimated by the supplier in technical offer. (b) Supplier must provide the list of organizations using same equipment in Pakistan (if any). (c) Equipment must be a standard product of OEM available at web address of OEM. (d) In case of premature failure of the equipment, OEM has to replace / rectify the item free of cost. Required transportation charges would be borne by the supplier.</p>						

<p>Firm Name: _____</p>
<p>Signature: _____</p>
<p>Name: _____</p>
<p>Designation: _____</p>



Annex-B

TECHNICAL OFFER

NUTECH / SCM / Mechanical Lab Eqpt (PSDP) 2020 / TD-146

Fill in following essential parameters:-

1. Validity of Offer: _____ Days (Should not be less than **120 days**)
2. Delivery period: _____ Days (After placement of order)
3. Country of Origin: _____
4. Warranty Period: _____

General

1. GST Number: _____ (Enclose Copy)
2. NTN / CNIC: _____ (if exempted, provide valid exemption certificate)

Payment Terms

1. 80 % through LC on sight.
2. 20% after delivery, installation / commissioning, user satisfaction certificate.

Details of Foreign Principal Information with account details)

1. Name / Title: _____
2. Address: _____

OEM Name:	Firm Name:	Signature:
OEM Focal Person:	Firm Focal Person:	Official Seal:
OEM Phone Number:	Firm Phone Number:	Name:
OEM Email Id:	Firm Email Id:	Designation:

Annex CFINANCIAL OFFER

Ser	Part No	Item Name/Size	Specification	A/U	Qty Req	Price Per Unit (USD)	Total Price (USD)
1.		Determination of Gear Efficiency	<ul style="list-style-type: none"> • Three-phase AC motor with variable speed of, power output: 0,20kW, speed: 0...2500 revolutions min⁻¹ • Magnetic particle brake, rated braking torque at exciting current 0...0.2A: 0...8Nm • Two-stage spur gear, transmission ratio should be minimum of 13,5 torque: min, 23.4Nm • Worm gear with minimum of transmission ratio: 15, torque: 10Nm, worm: z=2, worm gear: z=40 • Measuring ranges, speed: 0...3000min⁻¹, force: 0...100N • Unit should be compatible with the following electric combinations 230V, 50Hz, 1 phase 230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase • Efficiency of the unit should be displayed in digital form <p><u>Experimental Capabilities</u> Determination of the mechanical efficiency of gears by comparing the mechanical driving and braking power for a) Spur gears b) Worm gears c) Helical gears</p> <ul style="list-style-type: none"> • Determine the speed ratios over gears teeth ratios • Determine the torque variations over the applied loading conditions • Determine of the backlash over a) spur gears b) helical 	No	1		

			gears c) worm gears				
			<ul style="list-style-type: none"> • Predictions of transmission ratios • Predictions of torque transmissions 				
2.		Torsional Oscillations Apparatus with DAQ system	<ul style="list-style-type: none"> • Unit for studying torsion in shafts with rotation motion, torsional rigidity and the behaviour of a torsional vibration system with one, two or three discs of inertia • Bench-top unit with adjustable legs • Anodized aluminium frame and panels made of painted steel. • Main metallic elements made of stainless steel. • Three-phase motor of 0.5 kW (Approximately) • Vibrational Exciters • Velocity measuring sensors • Optical sensors to visualize the loops of oscillations • Torsion bar (Approximate dimensions) with clamping system for securing the bar to the torsional system <ul style="list-style-type: none"> ▪ Diameter: 4 to 6 mm. ▪ Length: 1000-1500 mm. • Polar moment of inertia: $I_p = 1.27 \cdot 10^{-10} \text{ m}^4$. (Approximate) • Angle of rotation selector, with possibility of selecting among three different angles • At least three discs of inertia: <ul style="list-style-type: none"> • Disc 1 (2 units): diameter of 150 mm and mass of 2.6 kg. Moment of inertia $I = 0.00731 \text{ kg} \cdot \text{m}^2$. (Approximate) • Disc 2: diameter of 240 mm and mass of 4.9 kg. Moment of inertia $I = 0.06679 \text{ kg} \cdot \text{m}^2$ (Approximate) • Four angle of rotation sensors, resolution: 0.067 V/degree, effective measuring range of $\pm 45^\circ$. • Graduated rule of 1300 mm. • Advanced Real-Time SCADA software with Open Control, Multicontrol and Real-Time Control. 	No	1		

		<ul style="list-style-type: none"> • National Instruments Data Acquisition board (Minimum 230 KS/s, kilo samples per second) • Safety features utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software) • Set of compatible Weights and hangers (Like) <ul style="list-style-type: none"> • 6 weights of 200 g. (0.44 pounds) • 6 weights of 100 g. (0.22 pounds) • 2 weights of 50 g. (0.11 pounds) • 2 weights of 20 g. (0.044 pounds) • 2 weights of 10 g. (0.022 pounds) • 1 support hook of 100 g. (0.22 pounds) • Adjustable bars lengths to generate the oscillations • Bars supportable from different points to make the visual loops • Oscillation amplitude measuring sensors • A real industrial simulation system through SCADA • Control interface box • Visualization of all the sensors values. <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Study of the behavior of the torsional vibrations. • Study of the oscillation frequency. • Study of torsional vibrations of a system subjected to free torsion. • Study of torsional vibrations of a system subjected to forced torsion. • Calculation of the damping coefficient of a system subjected to torsional vibration. • Study of the resonance and phase shift in a system around its operation in the natural frequency • Study of the behavior of the torsional vibrations of a 				
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			<p>system with two and three discs of inertia.</p> <ul style="list-style-type: none"> • Determination of the torsional rigidity of a bar subjected to torsion • Determination of the modulus of rigidity of a torsion bar 				
3.		Multi-channel Measurement Amplifier with DAQ	<p>A 16-channel strain display instrument that connects to industry-standard strain gauges.</p> <ul style="list-style-type: none"> • Fully programmable display to match the strain gauges and their bridge connections • Two dynamic outputs to connect to suitable instruments, such as an oscilloscope or a chart recorder for measurement of transient strains • Direct connections for half and full strain bridge connections, with internal 'make-up' resistors • Fully programmable to match most types of strain gauges and connections • Range $\pm 10,000 \mu\epsilon$, dynamic strain range $\pm 2000 \mu\epsilon$. • Dynamic strain output ranges <ul style="list-style-type: none"> • 200 $\mu\epsilon$/Volt with full bridge connection • 400 $\mu\epsilon$/Volt with half bridge connection • 800 $\mu\epsilon$/Volt with quarter bridge connection • DAQ System • Strain Gauge Kit should be supplied along with following strain gauges <ul style="list-style-type: none"> • 10x type PFL-20-11 polyester foil strain gauges. Length 20 mm, rated 120 Ohms ± 0.3 Ohm, Gauge Factor 2.13 • 10x type FLA-10-11 alloy foil strain gauges. Length 10 mm, rated 120 Ohms ± 0.3 Ohm, Gauge Factor 2.10 • 10x type FLA-6-11 alloy foil strain gauges. Length 6 mm, rated 120 Ohms ± 0.3 Ohm, Gauge Factor 2.12 	No	1		

			<ul style="list-style-type: none"> • Required solvents, cleaners, neutralizing cleaners, adhesive rubber strips, sufficient quantity of coloured wires, terminal tags, soldering iron and solders, adhesives etc 				
4.		Hydraulics and Electrohydraulic Trainer with DAQ system	<ul style="list-style-type: none"> • Trolley (Aluminium Channel) with frame & caster wheels with Brake • A modular unit consisting of variety of optional kits and elements to configure the desired Hydraulic and Electro-Hydraulic circuit • Hydraulic tank with minimum of 8 Litre capacity, • Oil cleanliness: With suction filter and return line filter • Hydraulics kit containing components to understand the fundamentals and advanced concepts of the hydraulic circuits <ul style="list-style-type: none"> • Pressure control valves and Pressure limiting valve for Pressure regulation from 5 to 50 bars • Flow control valves: <ul style="list-style-type: none"> • Shut-off valve. • Adjustable flow control valve: • Knob to regulate the flow.. • Manual distribution valves: • Hydraulic actuators: <ul style="list-style-type: none"> • Double effect cylinder made of stainless steel. Diameter: 40 mm and Stroke of 200 mm. • Connection parts and accessories: <ul style="list-style-type: none"> • Set of 5 hoses with quick-fit connectors: • 0.6 m hose (2 units). • 1 m hose (2 units). • 2 m hose. • Cross-shaped manifold with manometer with range from 0 to 100 bar with damping • Tank to perform volumetric measures with minimum 	No	1		

			<p>Capacity of 3 litres and overflow protection</p> <ul style="list-style-type: none"> • Digital tachometer with built in laser pointer and high visible digital 5 digit, 13 mm, LCD display for fast and accurate Non-contact RPM and surface speed measurements of rotating objects • Electro-Hydraulics kit containing components to understand the fundamentals and advanced concepts of the electro-hydraulic circuits. <ul style="list-style-type: none"> • Pressure control valves and Pressure limiting valve for Pressure regulation from 5 to 50 bars • Flow control valves: <ul style="list-style-type: none"> • Shut-off valve. • Adjustable flow control valve with pressure compensation • Check valve for flow control with bypass. • Hydraulic solenoid valves: <ul style="list-style-type: none"> • Bistable 4/2 solenoid valve: <ul style="list-style-type: none"> ○Electric activation. ○Maximum flow: 60 l/min. ○Maximum pressure: 350 bar. ○LED indicator. • 4/3 solenoid valve with P-T centre linked with Electric activation, Tandem centre, P-T linked, Spring return, with Maximum flow: 60 l/min Maximum pressure: 350 bar • 4/2 solenoid valve with spring return (2 units) with Electric activation, Spring return, Maximum flow: 60 l/min and Maximum pressure: 350 bar. • 4/3 solenoid valve with closed centre (2 units) with Electric activation, Closed centre, Spring centred, Maximum flow: 60 l/min and Maximum pressure: 350 bar. 				
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			<ul style="list-style-type: none"> • Hydraulic actuators like Double effect cylinder with Diameter: 40 mm, Stroke of 200 mm. • Should have Sensors like Pressure switch, Inductive proximity sensor, two Reed effect proximity sensor, Limit switch • Hydraulic Actuators kit for learning the concepts behind the most common hydraulic actuators as hydraulic motors, hydraulic cylinders, etc • Pressure control valves, Flow control valves, Manual distribution valves, Double control valve with joystick, Hydraulic actuators, required sensors and connections • Kit for Measurement and Proportional Control, configured to perform the analogue signal and the proportional control over the hydraulic actuators to implement a PID control from the computer. <ul style="list-style-type: none"> • Control Interface box, PID controller, <ul style="list-style-type: none"> ○ P controller: Kc: -10 to +10. ○ I controller: Ti: 0 to 100 s. ○ D controller: Td: 0 to 100 s. Sample time: 0.1 to 100 ms. • Electric comparator, 4 analogue inputs, and 4 analogue outputs • SCADA system with PCI Express Data acquisition board (National Instruments) with <ul style="list-style-type: none"> • Analog input for Number of channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536 • Sampling rate up to: 250 KS/s (kilo samples per second) • Analog output Number of channels=2. Resolution=16 bits, 1 in 65536. Maximum output rate 				
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			<p>up to: 900 KS/s</p> <ul style="list-style-type: none"> • Digital Input / Output Number of channels=24 • Pressure control valves, Flow control valves, Hydraulic Solenoid Valves, Hydraulic actuators, required sensors and connections <ul style="list-style-type: none"> • Hydrostatic Steering System kit designed to teach the most common components of the steering system with Distribution valves containing, Maximum flow: 5 l/min, Maximum pressure: 350 bar • Hydraulic and Electro-Hydraulic troubleshooting kit containing Pressure control valves, Flow control valves, Distribution valves, Hydraulic actuators, required sensors and connections <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Hydraulic Pump Troubleshooting • Flow Measurements • Hydraulic actuators troubleshooting's • Cylinder cushions and boosts • Motor troubleshooting • Hydraulic directional control valve troubleshooting • Hydraulic system troubleshooting • System level troubleshooting • Machine sequence troubleshooting • Machine performance troubleshooting • Hydraulic Filter Maintenance and calibration unit • Fitting and seals systems in a hydraulic unit • Flushing of fluid in a hydraulic systems • Adding of hydraulic fluid in a system • Tubing and component installation 				
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5.		Pneumatics Trainer with DAQ system	<ul style="list-style-type: none"> • Multi way valves of type pressure, shut-off and flow control valves • electric limit switch, • proximity switches, • solenoid valves, • signal boards • PLC with programming software • integrated power supply unit to supply the electro pneumatics and the PLC • distributor block for simultaneous use of both panels, hoses, cables, • Air Compressor (Low noise 40 d B (A) / 1 m) Suction capacity: 50 l / min and Pressure: 8 bars • Air Cylinders with Adjustable Cushions • Grooved plate • Membrane dryer, a reliable, effective and cost-efficient alternative for compressed air drying. • Measuring device for setting the end position damping with measuring range damping max. 64 mm, Minimum piston speed 0.2 m/sec and display LED 3-colour Interfaces • Three-Position Pneu-Turn Rotary Actuators • Micro-Line 3-Way Air Switches • Original Line Three-Position Cylinder • Air Pilot Valve • Solenoid Valve • Dual Air Manifold • Power Supply • PIV-Pneumatic Isolation Valves • Push Button valve • Toggle Valve 	No	1		
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		<ul style="list-style-type: none"> • Connecting Pipe roll • Elbow connector pack • Straight connector pack • Manifold connector pack • Pipe Cutter • Bracket for rod less cylinder • T-connectors <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Pneumatics power systems • Pneumatics circuits • Pressure and flow of air using pneumatics based units • Speed control circuits • Directional control valves • Demonstration of Air logic based system • Pneumatics maintenance • Schematics • Air flow and resistance • Flow control valves • Demonstration of cam valves for pneumatics control systems 				
6.	Weights and DAQ system for Cam and Follower Apparatus	<ul style="list-style-type: none"> • DAQ System for capturing data and show live traces (on a computer screen) of the follower movement – even at bounce • Set of weights and hooks like <ul style="list-style-type: none"> • 6 weights of 200 g. (0.44 pounds) • 6 weights of 100 g. (0.22 pounds) • 2 weights of 50 g. (0.11 pounds) • 2 weights of 20 g. (0.044 pounds) • 2 weights of 10 g. (0.022 pounds) 	No	1		

			<ul style="list-style-type: none"> • 1 support hook of 100 g. (0.22 pounds) • Compatible with model “MEX-Cam and Follower Mechanism” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Demonstration and Measurement of Cam bounce speeds for different cam and follower combinations • Demonstration of the action of a plate cam and an eccentric with different geometrical profiles and various types of followers • Demonstration of the conversion of the circular motion of a plate cam into the angular motion of a roller follower. • Demonstration of the conversion of the circular motion of a plate cam into the linear motion of a flat follower. • Study of the influence of the roller follower's diameter in the conversion of the circular motion of the plate cam into the angular motion of a roller follower. • Determination and graphical illustration of the relationship between the displacement of the follower and the angular displacement of the cam for several types of cams and followers. • Measurement of the force needed to be overcome in order to rotate a cam at different angular positions. 				
7.		Simple Gear System with DAQ System	<ul style="list-style-type: none"> • Self-contained bench-mounted base unit for dynamic performance tests – including a dual-purpose simple and compound gear drive units • Optional drive units, including belt drives and a chain drive for comparative tests of different drive types • A variable-speed, High stability, low-voltage drive motor for providing the shaft input turning force. 	No	1		

		<ul style="list-style-type: none"> • Power output approximately 15 W at 1000 RPM • A hysteresis effect dynamometer brake, constant dissipation for providing a constant torque at any given speed • Motor RPM measuring system with range of 3000 rev per min • Torque Measuring via a load arm bearing onto an electronic load cell • Display system for Motor Speed, Torque and Power • Drive units for working with the Geared Systems Base Unit for dynamic tests on performance, allowing comparison with the gear drive • Three shafts, with one gear on shafts 1 and 3, and two on shaft 3. <ul style="list-style-type: none"> ○ Shaft 1 has a gear of 80 teeth. ○ Shaft 2 has a gear of 60 teeth and a gear of 120 teeth. ○ Shaft 3 has a gear of 120 teeth • Flywheel should be a single wheel of radius 48 mm including 5x Weight Hangers, 150x 10 g masses, 15x 1 g masses <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of different geared systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of gear trains • Calculation of Mechanical advantage, velocity ratio and dynamic efficiencies of drive units toothed belt drive, round belt, chain drive and helical gear 				
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			<ul style="list-style-type: none"> • Chain and belt drive tension, including different methods of application • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of geared drive systems by calculated and experimental methods 				
7a	Toothed Belt Drive Model	<ul style="list-style-type: none"> • Flexible tooth belt with adjustable tension • Driver with min 25 teeth • Follower with min 40 teeth • Tools needed to fit the drive units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture A” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of toothed belt drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Toothed belt drive tension, including different methods of application • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of belt drive systems by calculated and experimental methods 	No	1			
7b	Round Belt Drive Model	<ul style="list-style-type: none"> • Flexible, round cross sectioned belt with adjustable tension 	No	1			

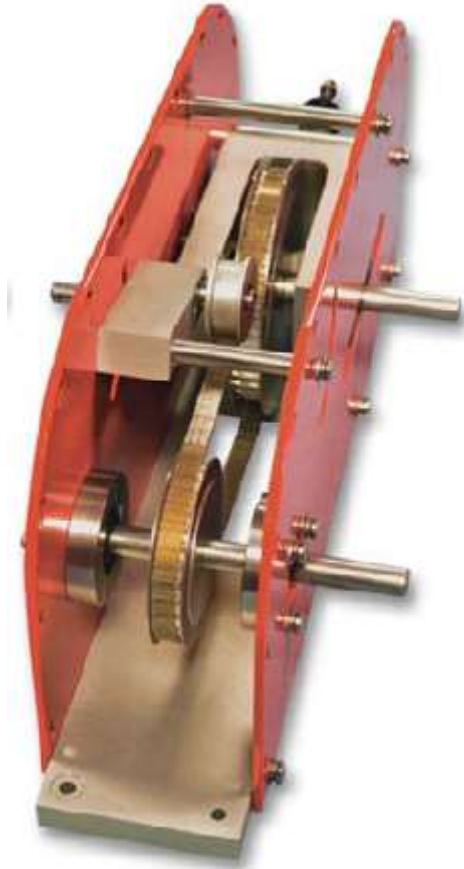
		<ul style="list-style-type: none"> • Driver min dia: 35mm • Follower min dia: 55mm • Tools needed to fit the drive units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture B” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of round belt drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Round belt drive tension, including different methods of application • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of round belt drive systems by calculated and experimental methods 				
7c	Chain Drive Model	<ul style="list-style-type: none"> • Roller chain with adjustable tension • Driver with min teeth: 15 • Follower with min teeth: 25 • tools needed to fit the drive • units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture C” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of chain drive systems • Calculation of Mechanical advantage 	No	1		

			<ul style="list-style-type: none"> • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of chain drive systems by calculated and experimental methods 				
7d	Helical Gear Drive Model	<ul style="list-style-type: none"> • Driver with min teeth: 70 • Follower with min teeth: 110 • tools needed to fit the drive units to the base unit, and to adjust the compound gear drive unit • Picture attached as “Picture D” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Measurement of velocity ratios and efficiencies of helical gear drive systems • Calculation of Mechanical advantage • Calculation of velocity ratio • Calculation of dynamic efficiencies of drive model • Comparison of and calculation of Mass moment of inertia of a flywheel from calculated and experimental values • Comparison and Calculation of Mass moment of inertia of helical gear drive systems by calculated and experimental methods 	No	1			
7e	Acceleration and Static Test Stand	<ul style="list-style-type: none"> • Stand should an option to connect with data acquisition system • Able to measure the angular acceleration and static efficiency of the attached system i.e. flywheel, compounded gear system, belt drive system, chain 	No	1			

		<p>drive system</p> <ul style="list-style-type: none"> • Masses to apply load on attached unit to stand. Limit of each weight should be of minimum 5 grams, • The test stand should include sets of weights to apply turning forces to the shaft of a flywheel or from the gear drive. • A sensor which automatically calculates angular acceleration. • A slot to the front of the test stand should hold a tray to store weights and other loose items • Picture attached as “Picture E” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Demonstration and calculations of static test efficiency of geared systems • Analysis of the static tests and dynamic tests of geared models, chain drive models and belt driven models • Mechanical Advantage, Velocity Ratio and static efficiencies of gear drives • Mass moment of inertia of a flywheel by experiment and calculation • Mass moment of inertia of geared drive systems by experiment and calculation 					
Total Amount							

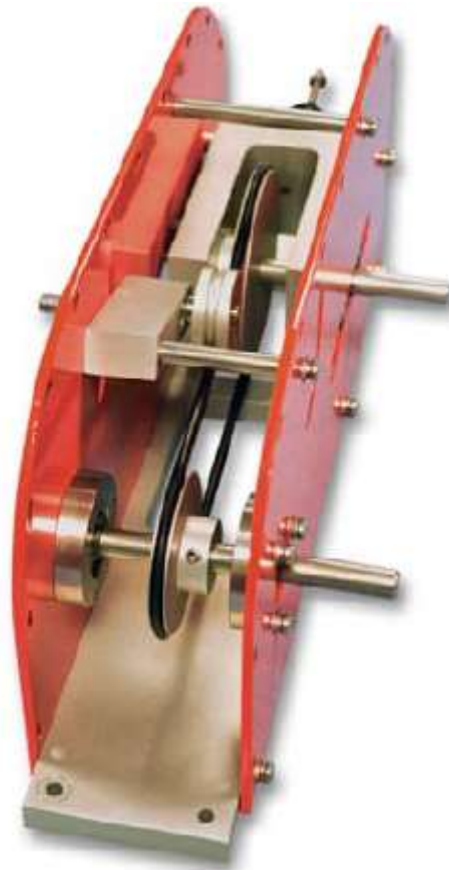
Firm Name:	_____
Signature:	_____
Name:	_____
Designation:	_____

Picture A



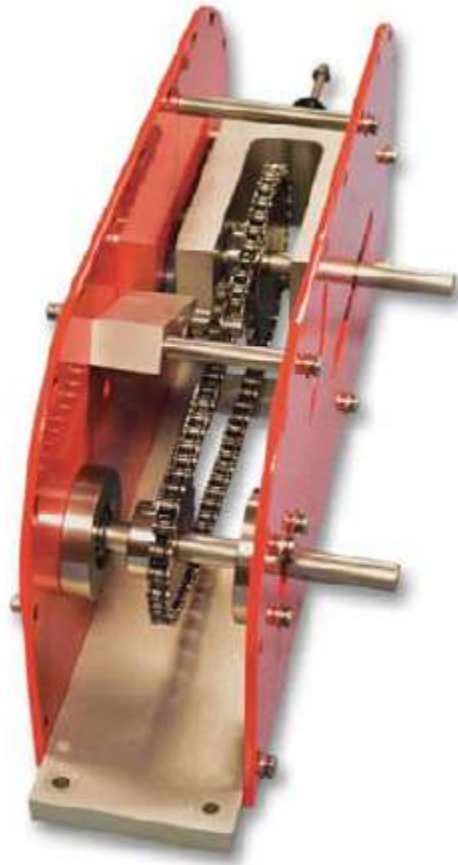
Toothed Belt Drive Model

Picture B



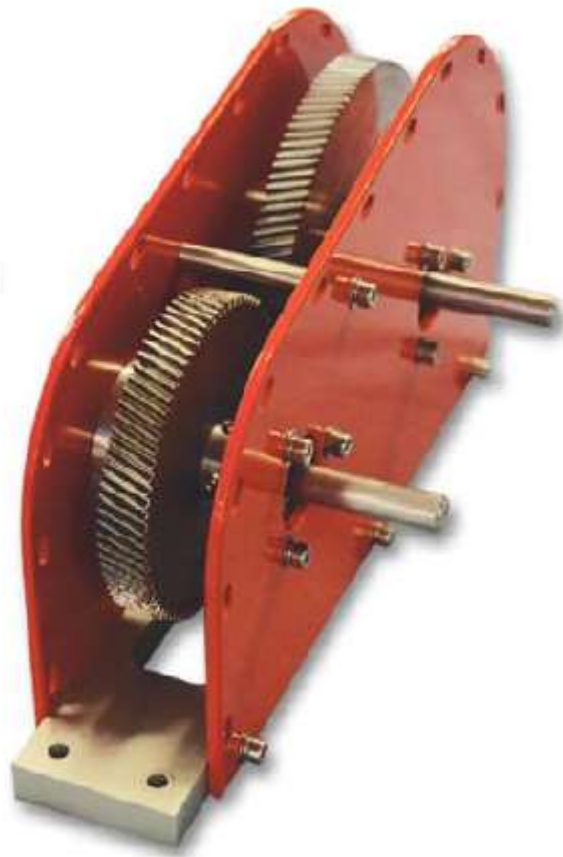
Round Belt Drive Model

Picture C



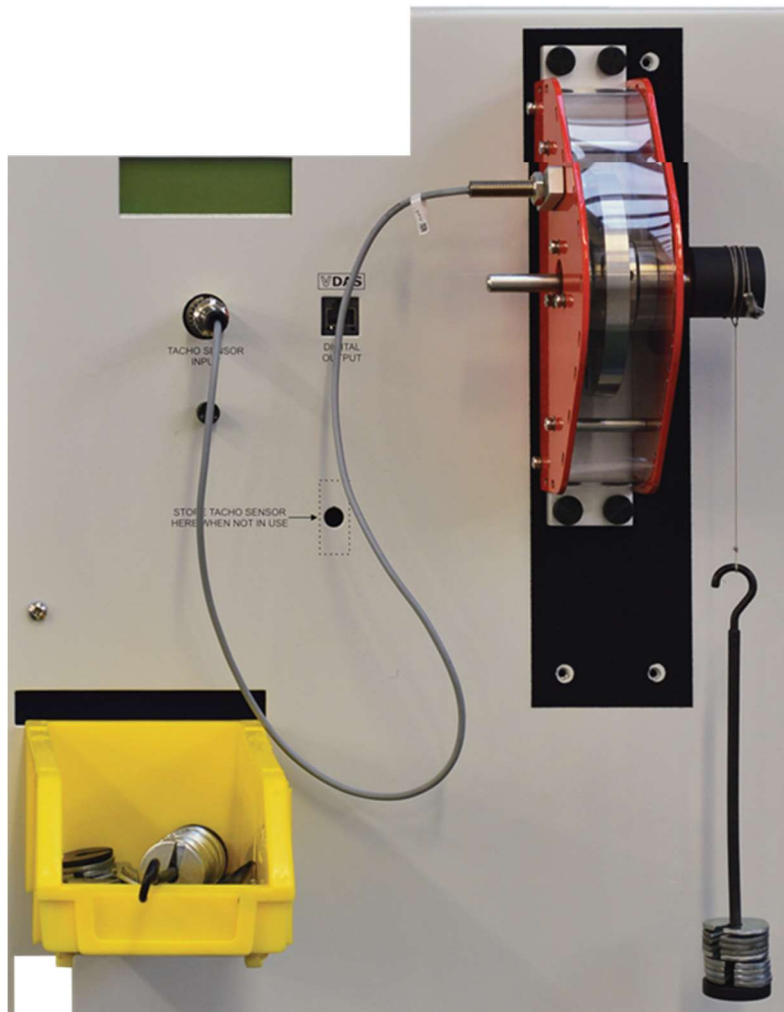
Chain Drive Model

Picture D



Helical Gear Drive Model

Picture E



Acceleration and static test stand

Tender No _____

Name of the Firm _____

Firm Address _____

Date _____

Telephone No _____

E-Mail _____

To,

DD SCM Office
NUTECH University
I-12, Main IJP Road,
Islamabad.

Dear Sir

1. I / We hereby offer to supply to the NUTECH University the stores detailed in schedule to the tender inquiry or such portion thereof as you may specify in the acceptance of tender at the price offered against the said schedule and further agree that this offer will remain valid up to 90 days after opening of Financial offer and will not be withdrawn or altered in terms of rates quoted and the conditions already stated therein or on before this date. I / we shall be bound by a communication of acceptance to be dispatched within the prescribed time.

2. I / we have understood the instructions to Tenders and General Conditions Governing Contract available at NUTECH website and have thoroughly examined the specifications / drawing and / or patterns quoted in the schedule here to and am/are fully aware of the nature of the stores required and my/ our offer is to supply stores strictly in accordance with the requirements.

Yours Faithfully.

(Signature of Tenderer)

Designation

Date:

Individual signing tender and / or other documents connected with a contract must be signed by principal authorized rep/ OEM rep/ Authorized partner firm rep.

SPECIMEN FOR "ADVANCE PAYMENT BANK GUARANTEE"

Guarantee No: _____ Date _____ Amount: _____ Valid upto: _____

In Favour of:

National University of Technology (NUTECH), IJP Road, I-12, Islamabad

Subject: **Advance Payment Bank Guarantee**

Contract No: _____ DATED. _____

Dear Sir,

1. We [Name of Guarantor] understand that you have entered into contract with M/S [Name of Firm] (hereinafter called Our Client), for provision of [Name of Stores]. And as per the above mentioned Contract, you are liable to pay to Our Client an amount of [Amount of Guarantee] in advance, which shall be released against a Bank Guarantee.
2. Bank & seller firm shall inform your office regarding termination of the validity of this bank Guarantee one clear month before the actual expiry date of this Bank Guarantee.
3. Now, we hereby irrevocably undertake to immediately make payment on to your orders, merely upon receipt of your first written notice, an amount not exceeding [Amount of Guarantee] that may be claimed by you at your own discretion without it being necessary for you to prove or even assert to the Bank any default whatsoever of Our Client under the Contract.
4. Claims against this Guarantee shall be lodged on us through written request/s on your proper Letter Head. Unless claims are not presented on or before the Validity Date, all rights and benefits under this guarantee shall be forfeited and we shall be released from all claims, demands or liabilities of any kind whatsoever.
5. This Guarantee shall remain in force up to the above mentioned Validity Date which can however, be extended upon request of Our Client.

Yours faithfully,

Signature: _____

Name: _____

Designation: _____

Bank Stamp:

BANK GUARANTEE AGAINST
"SPECIMEN FOR PERFORMANCE/WARRANTY
GUARANTEE"

Guarantee No: _____ Date _____ Amount: _____ Valid upto: _____

In Favour of:

National University of Technology (NUTECH), IJP Road, I-12, Islamabad

Subject: **In compliance with terms of Performance/Warranty Guarantee**
Bank Guarantee

Contract No: _____ dated _____

Dear Sir,

1. Whereas your good-self have entered into Contract No: _____ dated _____ with M/s [Firm Name] Located at [Firm Address], Herein after referred to as our customer and that one of the conditions of the Contract is submission of Bank Guarantee by our customer to your good-self for a sum of [Amount].
2. Incompliance with this stipulation of subj contract, we hereby agree and undertake as under:-
 - a. To pay to you unconditionally on demand and / or without any reference to our Customer an amount not exceeding the sum of [Amount] as would be mentioned in your written Demand Notice.
 - b. To keep this Guarantee in force till [Validity Date].
 - c. That the validity of this Bank guarantee shall be kept two clear year ahead of the original / extended delivery period or the warrantee of the stores which so ever is later in duration on receipt of information from your office. Our liability under this Bank Guarantee shall cease on the closing of banking hours on the last date of validity of this Bank Guarantee. Claim received there after shall not been entertained by us whether you suffer a loss or not. On receipt of payment under this Guarantee, this

documents i.e., Bank Guarantee must be clearly cancelled, discharged and returned to us.

- d. That we shall inform your office regarding termination of the validity of this bank Guarantee on clear month before the actual expiry date of this Bank Guarantee.
- e. That with the consent of our customer you may amend / alter any term / cause of the contractor add / delete any term / clause to / from this contract without making any reference to us. We do not reserve any right to receive any such amendment / alternation or addition / deletion provided such like actions do not increase our monetary liability under this Bank Guarantee which shall be limited only [Amount.....].
- f. That the bank guarantee herein before given shall not be affected by any change in the constitution of the Bank or Customer / Supplier or Vendor.
- g. That this is an unconditional Bank guarantee, which shall be cashed on sight on presentation without any reference to our Customer / Supplier or Vendor.

Signature_____

Name_____

Desig_____

Bank Stamp_____

Note: No changes in the above given BG format shall be accepted.

"SELLER'S WARRANTY CERTIFICATE"

(To be provided on stamp paper)

Contract No: _____ Dated:

Validity ____ years from the date of final acceptance of the Stores.

We hereby guarantee that we are the genuine and original Source of provisioning the Stores to our Buyer. We also undertake that nothing in the manufacturing of these Stores has been obtained through unauthorized means.

1. We hereby warrant and undertake that the Stores and all the associated spares/ accessories supplied under the terms and conditions of the above Contract, are:

- a. brand new, complete in all respects, possessing good quality and standard workmanship; and
- b. liable for replacement/rectification free of charge, if during the Warranty period the same are found defective before or under normal use or these do not remain within the limits and tolerances stated under the specifications or in any way not in accordance with the terms of this Contract. All expenses incurred in removal, re-provisioning and reinstallation of such defective Stores or their parts shall also be borne by us.

2. The Warranty shall remain valid for a period of ____ years from the date of final acceptance of the Stores.

Signature & Stamp _____

Name & CNIC _____

Designation: _____

Date: _____

****Sellers warranty must be provided by the Seller (firm) on Rs 100 stamp paper along with bank guarantee/CDR/Pay Order without changing a word. BG with additional clauses will be rejected.**

CHECK LIST**(This checked list must be attached with your technical offer, duly filled and****Signed by authorized signatory)****Tender No _____****Date _____**

1	Tender Processing Fee	a. Tender processing fee ref no _____ b. Bank _____ c. Amount _____		
2	EM/ Bid Bond	a. EM/ Bid Bond ref no _____ b. Bank _____		
3	Form Annex A, A-1, B and C signed by Authorized Signatory		Yes	No
4	Offering specification of items as per IT		Yes	No
5	Accounting unit/Qty as per IT		Yes	No
6	Delivery Schedule as per IT		Yes	No
7	Country of origin of store _____			
8	Name of OEM:- _____			
9	Original Performa invoice (Mandatory)		Yes	No
10	Certified that there is no Deviation from IT conditions/ there is deviation from IT condition as per fol details		Yes	No
11	Blacklisting certificate on stamp paper. it is certified that our firm is neither default nor black listed by any govt organization directly or indirectly		Yes	No

Note: Fill and/or mark Yes/No where required

Signature of Firm Auth Signatory