



TENDER DOCUMENTS

Mechanical Lab Equipment

NUTECH / SCM /Mechanical Lab Eqpt (PSDP) 2020 / TD-107

NATIONAL UNIVERSITY OF TECHNOLOGY

TENDER NOTICE

National University of Technology (NUTECH)

NUTECH / SCM / Mechanical Lab Eqpt (PSDP) 2020 / TD-107

Sealed bids are invited from Government / FBR Registered Firms for the procurement of Mechanical Lab Equipment for NUTECH on **FOR Basis**.

1. 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 **7 Feb 2020**.
2. Quotations shall be submitted as per requirement of the tender documents.
3. 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).
4. Sealed bids with detailed specifications should reach on the following address latest by **1100 hours on 25 Feb 2020**. Late submission will not be entertained.
5. Bids will be opened at **1130 hours on 25 Feb 2020** at SCM Office.
6. Project is to be completed in **90 days** from the date of award of contract.
7. 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.

Deputy Director (Supply Chain Management)

NATIONAL UNIVERSITY OF TECHNOLOGY, UPROAD, I-12 ISLAMABAD

Tel: 0092-51-5476768, Ext: 227

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT
INVITATION TO TENDER

Tender submission time: 1100 hours, 25 Feb 2020

1. NUTECH desires to procure the list of item(s) / Store(s) on **FOR 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 FE/Local Currency (in Local Currency for FOR cases & in FE for FOB cases) in figures as well as in words 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 25 Feb 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 be 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 **(in FOB cases)**.
- 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**
- a. **In 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.
 - b. **In FOR cases** 50% advance payment will be made to the Seller on provision of unconditional Bank Guarantee/ CDR/ DD/ Pay order. 50% payment will made to the Seller after receipt and confirming the correctness of ordered specifications, installation, commissioning OR as the case may be.
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. **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.

13. **Taxes/ Duties/ Custom clearance** All taxes /duties /import Licenses Fee as applicable under government laws in Pakistan as well as country of supplier shall be on firm **(in FOR Case)**. NUTECH will provide applicable exemption certificates and documents **(In FOB Cases only)**.

14. **Insurance:-** Insurance will be NUTECH's responsibility through NICL **(in FOB Cases)**.

15. **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.

16. **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.

17. **Delivery Schedule.** Store will be delivered within 90 days from contract signing date.

18. **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.

19. **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.

20. **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.

21. **Redress Of Grievance.** In case of dispute, case shall be reviewed by 'NUTECH Redress of grievance committee and decision of NUTECH shall be final and binding on both parties.
22. **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).
23. **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.
24. **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.
25. **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.
26. **Change In Specification / Mfr / Model.** No alternation marked/brand and quality of store will be entertained after the tender have been opened.
27. **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.

28. **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 loss 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

29. **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.

30. **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. 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.
- e. 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.
- f. 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.
- g. An appropriate amount may be paid for mobilization against Bank Guarantee/CDR/Demand Draft/Pay Order.
- h. 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-107**

Ser	Part No	Items	Description	Country of Origin	A/U	Qty Req	Bidder Compliance		Tech Scrutiny to be done by user	
							Yes	No	Accepted	Rejected
							Reason of Rejection			
1		Cam and Follower with DAQ system	<ul style="list-style-type: none"> ○ Bench-mounted product to analyze the dynamic characteristics of different cams and followers and their 'bounce' speed under safe and controlled conditions ○ Includes different cams, followers, springs and masses for a wide range of experiments ○ Fully interlocked for safety ○ Action principal of cam mechanism ○ A motor shaft that connects through a coupling to the main shaft. ○ Self-aligning heavy-duty bearings to support the shaft ○ 2-4 cams: arc / tangent / concave / hollow / asymmetric ○ 2-3 followers: rollers and flat face ○ 1 roller follower 14 mm radius, 0.239 kg ○ 1 flat faced follower 0.56 kg ○ Angular scale for determining the angle of rotation, 0-360° with 1° graduation ○ Stem and Indicator ○ Dial gauge for determining the 	Europe/ USA	No	1				

			<p>stroke $D=\pm 20\text{mm}$</p> <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 <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Generate displacement curves for cam mechanisms ○ Predictions and calculations of results for the profiles of cam and followers with respect to displacement, velocity and acceleration ○ Measurement of rise and fall displacement of the cam ○ Influence of different cam shapes ○ Demonstration and Measurement of stroke <p>Demonstration and Measurement of Cam bounce speeds for different cam and follower combinations</p>						
2		Simple Gear System	<ul style="list-style-type: none"> ○ Bench/wall mounted base unit ○ Simple and compound gear trains with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Compounded Bevel gear systems with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, 	Europe/ USA	No	1			

			<p>transmission ratio should be minimum of 10</p> <ul style="list-style-type: none"> ○ Simple and Compounded helical bevel gear system with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Simple and compounded worm gear system with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Simple rack and pinion gear system with minimum of teeth 10 on pinion and 50 on rack. Rack length should be minimum of 100mm, transmission ratio should be minimum of 10 ○ Measuring range speed: Approximately 0...600 revolutions per min <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 <p>toothed belt drive, round belt, chain</p>						
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			<p>drive and helical gear</p> <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 <p>• Comparison and Calculation of Mass moment of inertia of geared drive systems by calculated and experimental methods</p>						
2a		Toothed Belt Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft as an input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) to the drive ○ Transparent cover for safety ○ Gear teeth: ± 80 ○ 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 Annexure '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 	Europe/ USA	No	1			

			<p>advantage</p> <ul style="list-style-type: none"> ○ 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 						
2b		Round Belt Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft as an input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) ○ to the drive ○ Transparent cover for safety ○ Gear teeth: min 80 ○ Teeth should be engaged and disengaged. ○ 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 Annexure 'B' 	Europe/ USA	No	1			

			<u>Experimental Capabilities</u> <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 						
2c		Chain Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) ○ to the drive ○ Transparent cover for safety ○ Gear teeth: min 80 ○ Teeth should be engaged and disengaged. ○ 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 	Europe/US A	No	1			

			<p>the compound gear</p> <ul style="list-style-type: none"> ○ drive unit ○ Picture attached as Annexure '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 ○ 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 						
2d		Helical Gear Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) ○ to the drive ○ Transparent cover for safety ○ Gear teeth: min 80 ○ Teeth should be engaged and disengaged. ○ 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 	Europe/US A	No	1			

			<ul style="list-style-type: none"> ○ drive unit ○ Picture attached as Annexure 'D' <u>Experimental Capabilities</u> <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 						
3		Whitworth Quick Return Mechanism	<ul style="list-style-type: none"> ○ Investigate reciprocating motion of slider and crank ○ Show how motion is converted in quick return mechanism ○ Investigating non uniform strokes ○ Crank min radius: 40mm ○ Slider min radius: 50mm ○ Driving rod min length: 100mm ○ Measurement of stroke in cylinder ○ Stroke length: 0-120mm ○ Adjustable crank radius and crank angle at min 3 positions ○ Anodized aluminum disk and rod ○ Picture attached as Annexure 'E' <u>Experimental Capabilities</u> <ul style="list-style-type: none"> ○ Converting motion with the help of 	Europe/US A	No	1			

			<p>quick return mechanism and ‘Scotch yoke’ (or ‘slotted link’)</p> <ul style="list-style-type: none"> ○ Investigating the revolving crank and slider ○ Measurement of stroke in cylinder ○ Investigation of non-uniform stroke movements ○ Investigation of effect of crank length on output stroke ○ Investigation of effect of input angle on output stroke ○ Generating curves and recording data for slider crank movement ○ Adjustment of the crank radius 						
4		Winch Mechanism	<ul style="list-style-type: none"> ○ Investigate lift velocity and load transmission of winch ○ Provide the parameters to calculate the efficiency and load transmission of winch mechanism ○ Anodized aluminum frame ○ 2 x gear wheel small and large with min 14 and 70 teeth respectively ○ Module: min 2 ○ Driving and driven pulleys ○ 4 x Weights for driving and 4 x weights for driven pulleys ○ Holders for driving and driven pulleys <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Investigating the velocity ratios ○ Finding hoisting velocity and force transmission ○ Investigating transmission ratio 	Europe/US A	No.	1			

			<ul style="list-style-type: none"> ○ Investigating unwinding rate ○ Investigating angular velocity ○ Investigating efficiency of winch ○ Determination of behaviour of winch 						
5		Four Bar Chain	<ul style="list-style-type: none"> ○ Investigate the mechanical relationship on four bar chain mechanism ○ Bench mounted on kinematic behaviour ○ Anodized aluminum discs and ball bearings ○ Anodized aluminum rods ○ 2-3 crank radii of 25mm, 37.5mm and 50mm ○ 2-3 Oscillation radii: 50mm, 100mm, 150mm, 200mm ○ 3-4 Connecting rod lengths: 50mm, 100mm, 150mm, 200mm ○ Protractor ranging 360° and 1° increment ○ Oscillating crank should be attached to a disc with its own protractor angle scale. ○ Demonstration of the operation of axle pivot steering ○ Picture attached as Annexure 'F' <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Investigating Grashof Law ○ Demonstration of mechanical relationship of four joint link ○ Investigating the principal of crank rocker mechanism ○ Investigating graphically the relationship between the angular 	Europe/US A	No	1			

			displacements of the input crank and the output joint <ul style="list-style-type: none"> Investigation of the principal of double rocker mechanism Investigation of velocity and acceleration output of the joints Graphically obtain velocity and acceleration diagrams 						
6		Slotted Link Apparatus	<ul style="list-style-type: none"> Unit is to provide the demonstration of the concept and working principle of pure simple harmonic motion. Disc mounted on bearing Holder to join surface of bearing Rotational scale on disc and can be checked at any position Bar displacement should be measured at any disc angle 2-3 crank radii min: 25mm, 37.5mm, 50mm Cylinder stroke min: 0-100mm Anodized aluminum disc and connecting rod Main parts: <ul style="list-style-type: none"> Scotch yoke Crank and slider Quick return mechanism Picture attached as Annexure 'G' <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> Demonstration of action of crank and slotted link mechanism Investigation the effect of crank length and input angle on output stroke Demonstrate the concept and 	Europe/US A	No	1			

			working principle of simple pure harmonic motion ○ Measurement of transmission function of crank slider ○ Measurement of stroke on the cylinder						
7		Bench Grinder	○ Cast iron base mounted unit ○ Wheel covers with in-built task lights ○ Incorporation of one eye-shield for close work ○ Induction motor for high speed material removal ○ Wheel Dia: 150-250mm ○ Hole Dia: 10-20mm ○ No load speed: 2500-4000rpm <u>Experimental Capabilities</u> ○ Should be able to grind the item it encounters ○ Shape, sharpen, buff, polish or clean the metal object	Any	No	2			
8		Portable Hand Drilling Machine	○ 1000-2000W small electric hand drilling machine specifications. ○ Drilling dia:100-150mm ○ Rated voltage: 110V/220~240V ○ Rated frequency: 50-60HZ Rated input power: 1000-2000W ○ No-load speed:2200-2800 r/min ○ Waterproof manner: Copper tube sealing ○ Portable core drill. ○ Picture attached as Annexure 'H' ○	Any	No	4			
9		Cutaway Air Compressor 2Hp	○ Sectioning of actual hardware. ○ Color-coding of the compressor	Any	No	1			

			components, and flow paths using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Reducer with pressure gauge ○ Picture attached as Annexure "I"						
10		Reciprocating Compressor (On Base) – Manual	○ Trainer for recording the characteristic curve of a two-stage compressor ○ Two cylinders with V-arrangement ○ Intake vessel, with orifice meter to measure the airflow rate ○ pressure sensor and additional gauges of temperature ○ pressure gauges for analogue display ○ Intercooler between first and second stage ○ Safety valve, control valve and outlet silencer ○ power consumption: 3-5kW ○ speed: 500-1000min-1 ○ intake capacity: 200-300L/min ○ quantity delivered: 180-220L/min ○ Operating pressure: 8-13bar, max. 35bar ○ Intake vessel: 18-25L ○ Digital display of Torque, speed and power ○ Low Pressure Cylinder: Bore 90-100mm; Stroke 40-60mm ○ High Pressure Cylinder: Bore 40-60mm; Stroke 40-60mm	Any	No	1			

			<u>Experimental Capabilities</u> <ul style="list-style-type: none"> ○ Understanding different components of functions of compressor ○ Measurement of efficiencies ○ Measurement of velocities ○ Measurement of air flow rate ○ Investigation of temperature at different stages of compression ○ Comparison of volumetric and thermal efficiencies ○ Determination of compressor performance ○ Showing compression process on P-V diagram 						
11		Cutaway Model: Carburetor	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the carburetor components using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "J" 	Any	No	1			
12		Cutaway Model: Fuel Injection Pump	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the pump components, and flow paths using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "K" 	Any	No	1			
13		Cutaway Model: Fuel Injectors	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the fuel injector components using contrast colors ○ Model should be mounted on 	Any	No	1			

			<p>suitable base of wood or metal approximately 4-6 inches high.</p> <ul style="list-style-type: none"> ○ Picture attached in annex “L” 						
14		Tool Kit 142 Tools or more	<ul style="list-style-type: none"> ○ 1/2 inches Hexagonal Socket, Star Socket, Dr. Flex handle, ratchet wrench, Extension bar, dr Universal joint, Spark plug socket ○ 1/2 inches (F) x 3/8 inches (M) three way adaptor ○ 1/2 inches x 10 inches L handle ○ 3/8 inches, 12 pt. socket, ratchet wrench, Extension bar, dr Universal joint ○ 1/4 inches x 25 mm Bit socket ○ Bit Holder ○ 1/4 inches Hexagonal Socket, Star Socket, ratchet wrench, Extension bar, dr. universal joint ○ 3/8 inches(F) x 1/4 inches (M) three way adaptor ○ 1/4 inches x 150 mm Spinner handle ○ 1/4 inches x 150 mm Flexible extension bar ○ Combination spanner ○ Flare nut spanner ○ Hex key ○ 300 g Machinist hammer ○ 7 inches Combination Pliers ○ 10 inches Curved jaw lock wrench ○ S2 Slotted, Phillips screwdriver ○ Stubby screwdriver 	Any	No	3			
15		Sand Casting Unit For Spark Plugs	<ul style="list-style-type: none"> ○ Unit should be bench mounted ○ Frame of unit should be metal based but aluminum based would be preferred 	Any	No	1			

			<ul style="list-style-type: none"> ○ Cleaning of the spark plugs should be based on sand blasting mechanisms ○ Picture attached in annex “M” <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of the cleaning of spark plugs ○ Demonstration of spark plug effectiveness after sand blasting 						
16		Spark Plugs Of All Types	<ul style="list-style-type: none"> ○ Spark plugs containing: ○ flash ribs ○ insulator ○ caulking ○ hex ○ shell ○ gasket ○ thread ○ center electrode ○ ground electrode ○ copper core ○ insulator tip ○ Copper/Nickel spark plugs ○ Single Platinum spark plugs ○ Double Platinum spark plugs ○ Iridium spark plugs ○ Silver spark plugs ○ Gapping spark plugs 	Any	No	25			
17		Cutaway Model: Rotary Engine	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the engine components using contrast colors ○ Light metal construction. ○ Operated manually by a crank handle ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. 	Europe/US A	No	1			

			<ul style="list-style-type: none"> ○ Picture attached in annex “N” 						
18		Cutaway Model: 2 Stroke, 4 Stroke Petrol And Diesel Engines	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the engines using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex “O” 	Any	No	1			
19		Cutaway Model: Cd-70 And Cg-125 Engine, Transmission And Complete Chassis Model	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the engine components, and flow paths using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex “P” 	Any	No	1			
20		Air Compressor (On Base) - Manual	<ul style="list-style-type: none"> ○ Investigating intake and delivery pressure airflow rate compressor ○ Two cylinders ○ Air flow rate sensor ○ Pressure sensor ○ Temperature sensor ○ Speed control sensor ○ Manometers ○ Inlet and outlet silencers ○ Safety valve ○ Control valve ○ Clean, dry air ○ Pressure: 5-15 bar ○ Air connection: 3/4” ○ Intake vessel ○ Pressure vessel <u>Experimental Capabilities</u> ○ Demonstration and availability of pressurized air ○ Air pressure comparison over screw 	Any	No	1			

			and reciprocating compressors						
21		Multi Disc Clutch Cutaway	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the components, internal surfaces, using contrast colors. ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Pic attached at Annex 'Q' 	Any	No	1			
22		Thermostatic Expansion Valve Cutaway	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the valve components valve body, internal surfaces, seat, and closure devices using contrast colors. ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Pic attached at Annex 'R' 	Any	No	1			
23		Screw Compressor (On Base) – Manual	<ul style="list-style-type: none"> ○ Screw Type Air Compressor unit capable of continuously supplying compressed air ○ Powered by a 3 phase A.C. electric motor ○ Receiver Tank ○ Safety Valves ○ Pressure gauge ○ Pressure Relief Valve, ○ Automatic Pressure Switch, ○ Suction Filter, ○ Oil Sight Glass, ○ Drain Valve, ○ Non Return Valve, ○ Starter for the motor. ○ Air delivery : 50-80 CFM ○ Receiver Air tank capacity: 500 litres minimum. 	Any	No	1			

			<u>Experimental Capabilities</u> <ul style="list-style-type: none"> ○ Demonstration of air pressure ○ Demonstration and comparison of air pressure using screw compressors over manual air compressors 						
24		Hydraulic Brake Training Bench	<ul style="list-style-type: none"> ○ Model should be mounted on suitable metal frame with dimensions ○ Unit should consist of minimum of two sets of hydraulics brakes ○ Pressure distribution systems to brakes should be visible to students ○ Pressure sensors/meters should be places to acquire the actual hydraulic pressures to brakes ○ Motor for driving the wheels to from 0...300 revolutions per min ○ Pic attached at Annex 'S' <u>Experimental Capabilities</u> <ul style="list-style-type: none"> ○ Demonstration of pressure applying on disc brakes ○ Demonstration and predictions of disc brakes effects over high speeds ○ Demonstration of frictional effects over disc brakes ○ Hydraulic pressure applying on brakes 	Europe/ USA/UK	No	1			
25		Electrical Wiring Trainer	<ul style="list-style-type: none"> ○ Low voltage pushbutton “doorbell” switch ○ Pilot light to indicate low voltage “ON” ○ A low voltage buzzer ○ Two standard duplex receptacles ○ GFI duplex receptacles ○ Two lamp sockets ○ Pilot light to indicate 120 VAC is 	Europe/ USA	No	1			

			<p>“ON”</p> <ul style="list-style-type: none"> ○ Two three-way toggle light switches ○ Standard residential 4 circuit breaker panel ○ Dual 24 VAC, 5 Amp pre-test panel with breaker ○ Three wire grounding AC 120V cord ○ Starter quantity of wire for trainer <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of residential wiring demonstrator ○ Demonstration of wiring and electrical distribution ○ Wiring instructions along with practice text ○ Demonstration of wiring needs over different areas and requirements with respect to current 						
26		Air-Fuel Mixture Measuring Apparatus	<ul style="list-style-type: none"> ○ Portable air fuel mixture testing unit ○ Measure the air fuel ratio of car/motorcycle in a running conditions ○ Unit should be operate-able on petrol engines ○ Identify and set the proportions of petrol fuel and air quantity before entering into the combustion chamber <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Analysis of air-fuel ratios in petrol engine over throttling conditions ○ Calculations of optimum air-fuel 	Europe/ USA	No	1			

			ratios for a petrol engine						
27		Cutaway Model: Radial Engine	<ul style="list-style-type: none"> ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Pic attached at Annex 'T' 	Imported	No	1			
28		Hooks Universal Joint	<ul style="list-style-type: none"> • Bench Mounted Unit • Universal Joints minimum set of 2 • Connecting shaft should be of stainless/steel • 360 degree marked disks minimum of two for measuring the angle of rotations • Universal joint connected columns should be mounted on disk with two disks marked with 360 degree rotations • End columns should be connected with ball bearings (minimum of 2) for smooth rotations <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Calculations of gimbal error • Demonstration of powers to automotive wheels • Demonstration of knuckle joints • Calculate the relative displacements of the shafts at opposite ends of a single and double Hooke's Joint. • To observe the effect of changing the angles between the axis of the coupling(s) and shaft on the relative angular shaft displacements 	Europe/ USA	No	1			

29		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, • Stand should be compatible with geared system, flywheel systems, belt drive units and chain drive units, <u>Experimental Capabilities</u> <ul style="list-style-type: none"> • Calculations of moment of inertia of geared systems • 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 	Europe/ USA	No	1				
----	--	---	-------------	----	---	--	--	--	--

			calculation						
30		Belt Friction Apparatus	<ul style="list-style-type: none"> Standalone unit for demonstrating advantages and disadvantages of three popular drive systems: belt, chain and a universal coupling, with a rotating frame with a low-friction cantilever linkages, adjustable masses and a spring to apply force Extra parts to demonstrate the importance of angle of lap around a pulley and its relationship with friction Must include Chain drive, Belt drive, Universal coupling and Weight hangers and weights <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> Power transfer, efficiency and direction in a belt drive Power transfer and efficiency in a chain drive Input and output relationships of a universal coupling Friction and angle of lap on a pulley 	Europe/ USA	No	1			
31		Ackermann Steering Demonstrator	<ul style="list-style-type: none"> Anodized aluminum frame and panels made of painted steel. Diagram in the front panel with distribution of the elements similar to the real one. The unit includes: <ul style="list-style-type: none"> Two levers made of aluminum. An intermediate steering rod 	Europe/ USA	No	1			

made of aluminum.

- Two track rods, with individual length adjustable by an adjustment nut.
- Two pivots.
- Two indicators to measure the steering angle.
- Two graduated discs for angle displacement. Measuring range of the steering angle: $\pm 50^\circ$. Scale graduation: 1° .

Experimental Capabilities

- Demonstrate and verifying the Ackermann's steering principle and determination of the lead angle of a steering trapezoid
- Calculate the wheelbase drive systems and the influence of the track rod length
- Determine the lead angle and the steering error
- Determining the variation on turns caused by track maladjustment.

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: 02°C to +60°C (b) Relative humidity: 0-70% non-condensing						
Warranty period Two years from the date of commissioning. A warranty sticker is to be pasted on each imported item by the Supplier / OEM highlighting Name of Firm, Contract No and date, Description of Store and Warranty validity						
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 Used (3) Trouble shooting guide (4) Cleaning requirements (5) Shipping and receiving (6) Storage requirements (b) IPB (Illustrated Parts Breakdown Manual) should have 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.						
Spares / Technical Support (a) Supplier to have in-country spares / technical support and ensure spares and technical support / assistance for next 10 years (b) Comprehensive list of spares required for scheduled maintenance of Equipment is to be provided (c) Any software provided must have its license (d) Software upgrade support must be provided free of cost for 10 x years with renewed license at every upgrade (e) Supplier must also provide calibration service for at least 5 x years after commissioning						
Additional Spare / Replaceable parts. (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. (b) All specialized / standard tools required for inspection / repair / servicing must be supplied along with equipment.						
Physical Inspection Criteria 100% Physical inspection of store will be carried out before commissioning of the equipment for following details:- a. For physical damage, scratches and deformity. b. Accessories/ Components as per contractual Specifications c. Technical Manuals (Operation Manual, user guide,IPBs) d. Quality Certificate and calibration certificate by the OEM 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. f. Brand name and country origin.						
Commissioning (a) Commissioning of the equipment will be carried out 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.						
Training 01 week OEM operational/ maintenance training at NUTECH						

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.						
Liability of Supplier (a) Verifiable 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						
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.						

Firm Name: _____

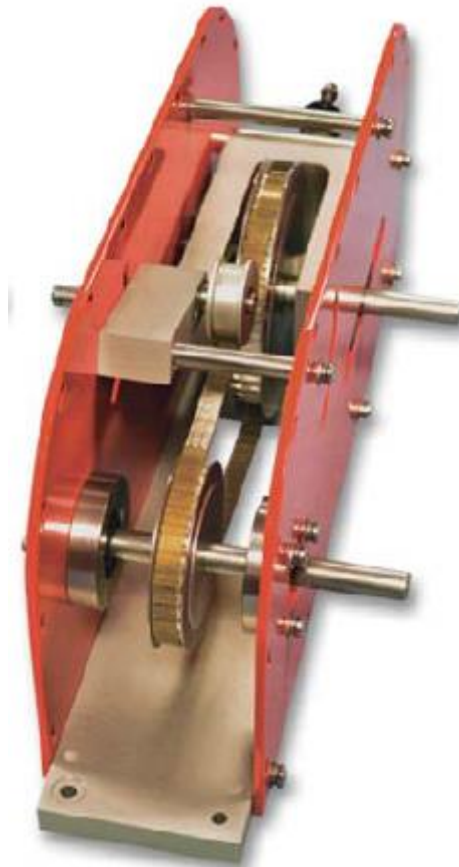
Signature: _____

Name: _____

Designation: _____

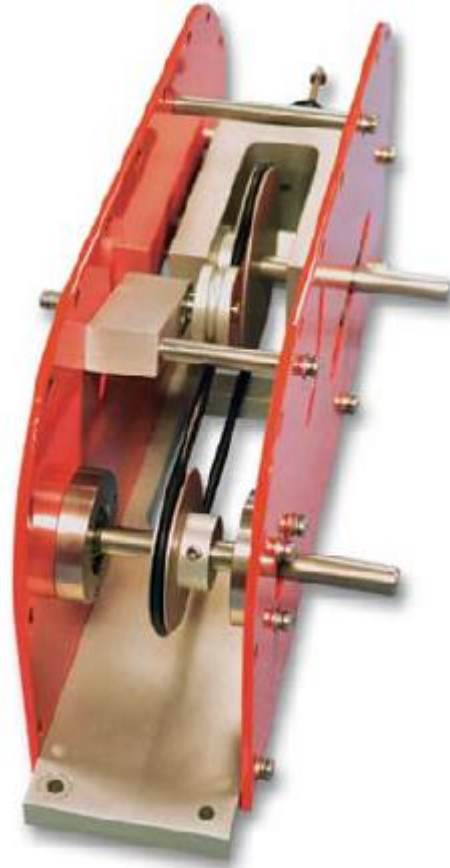
Reference Pictures

Annex-A



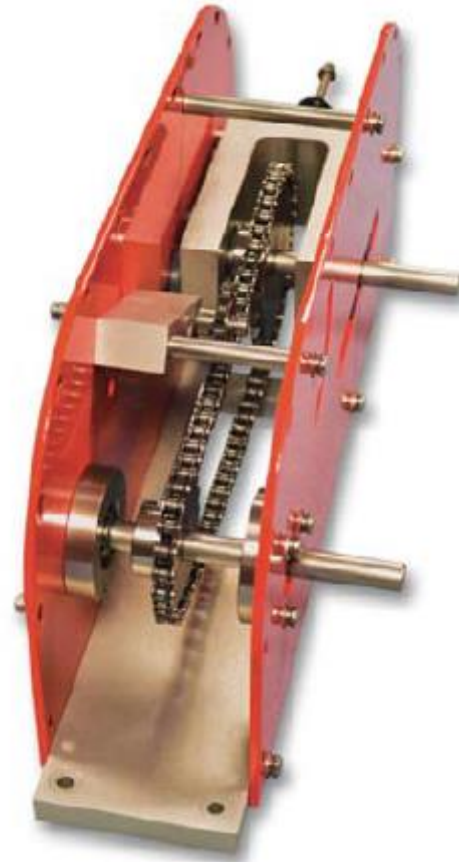
Toothed Belt Drive Model

Annex-B



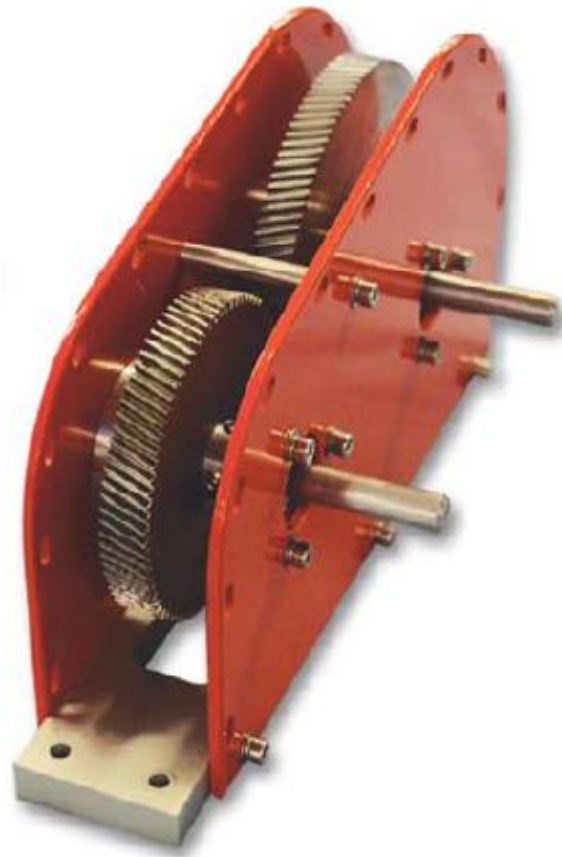
Round Belt Drive Model

Annex-C



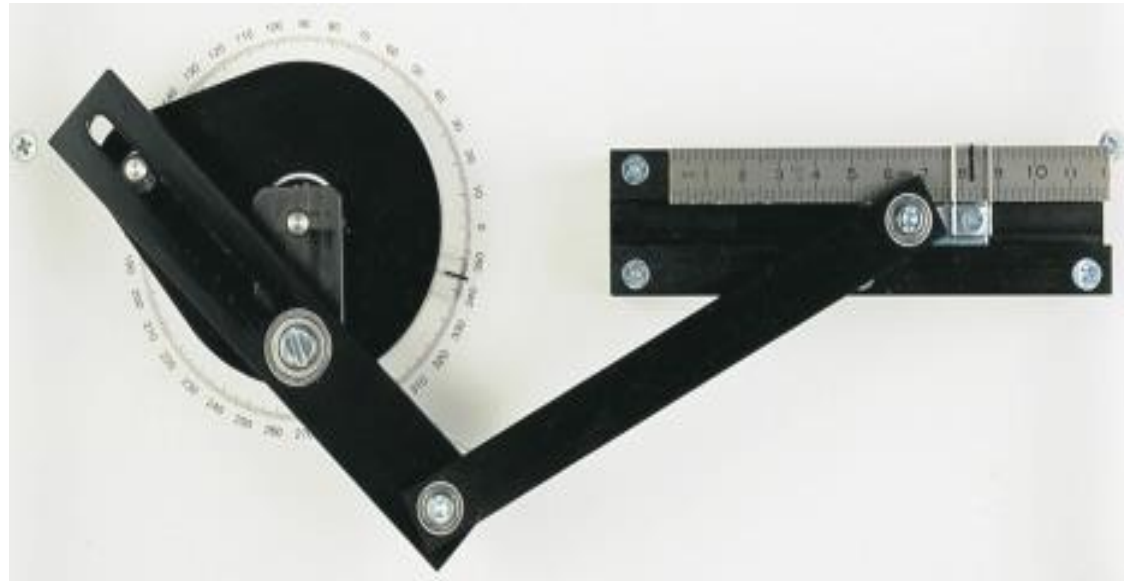
Chain Drive Model

Annex-D



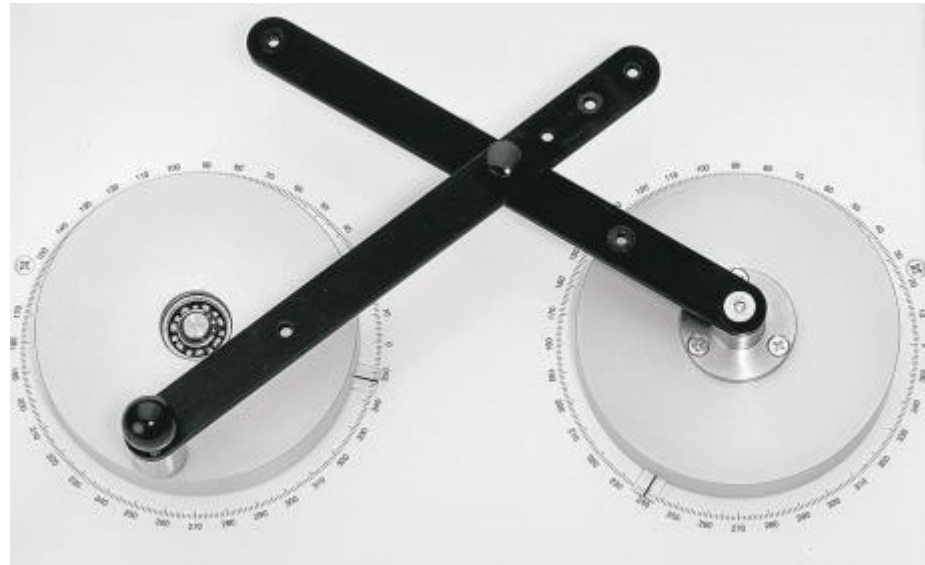
Helical Gear Drive Model

Annex-E



Whitworth Quick Return Mechanism

Annex-F



Four Bar Chain

Annex-G



Slotted Link Apparatus

Annex-H

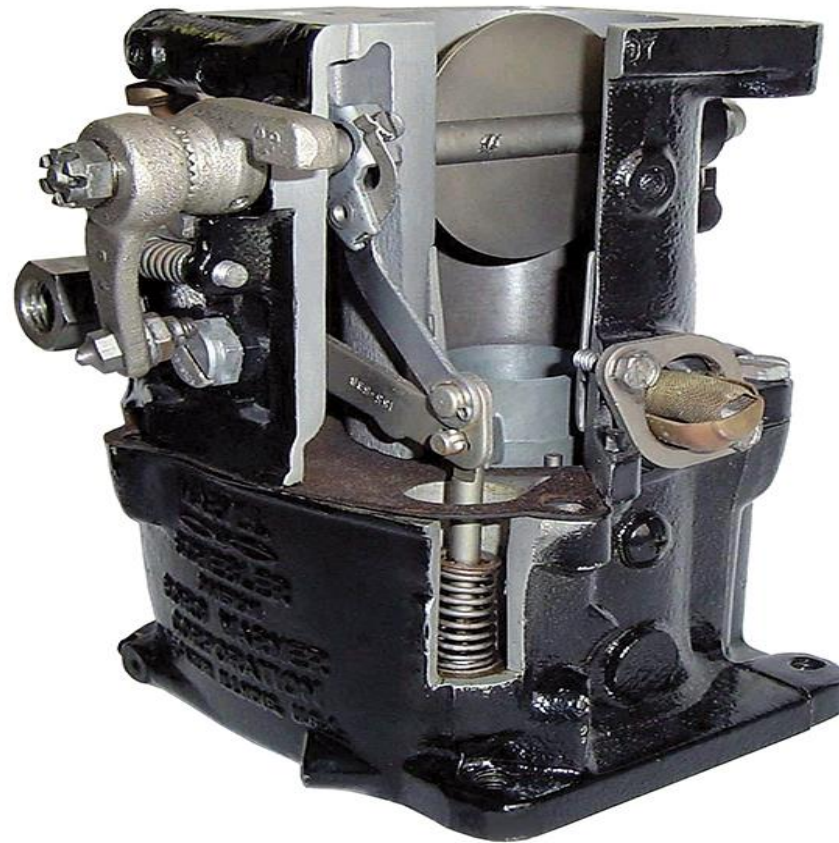


Portable Hand Drilling Machine

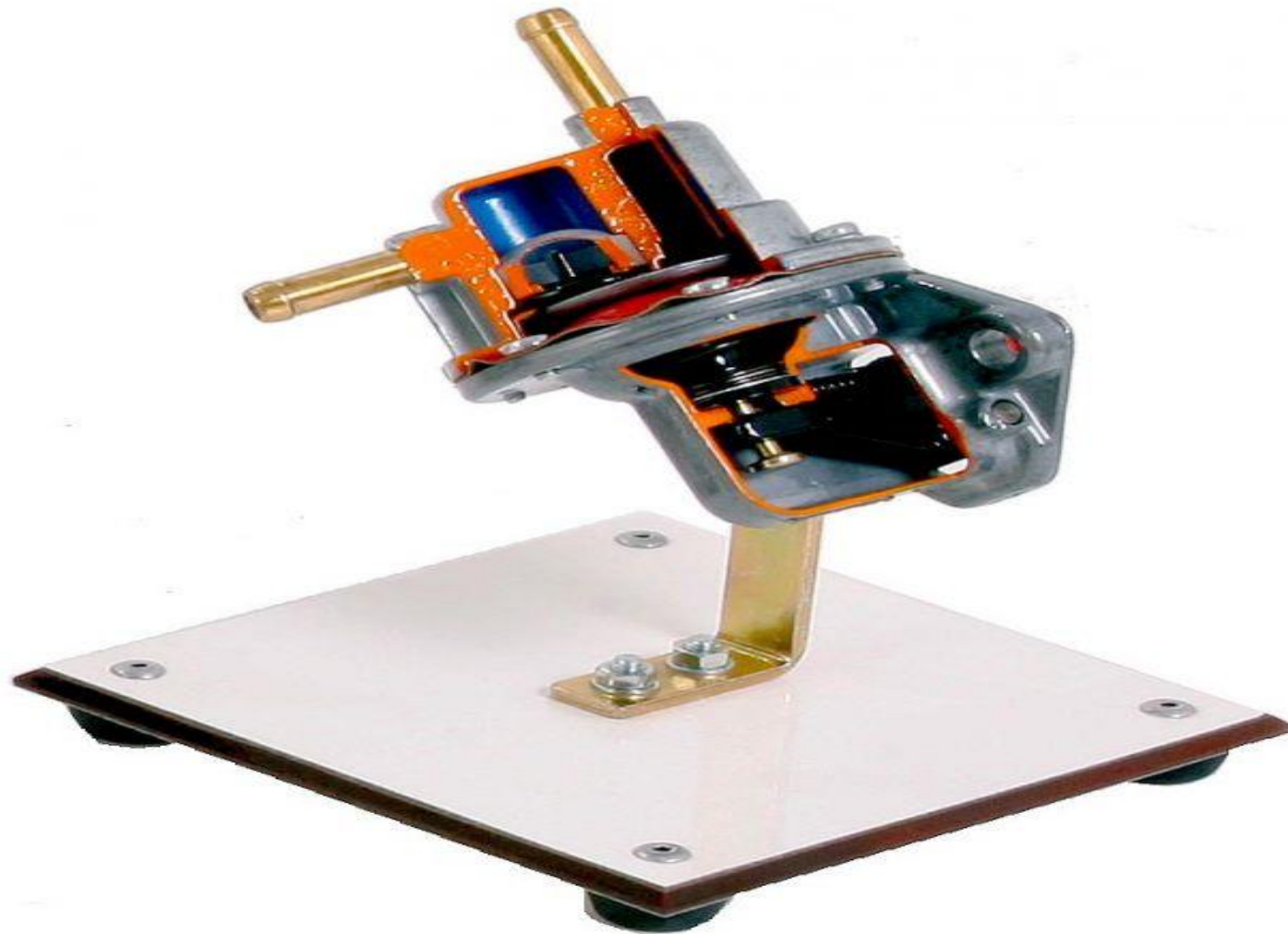
Annex-I



Cutaway Air Compressor



Cutaway Model: Carburetor



Cutaway Model: Fuel Injection Pump

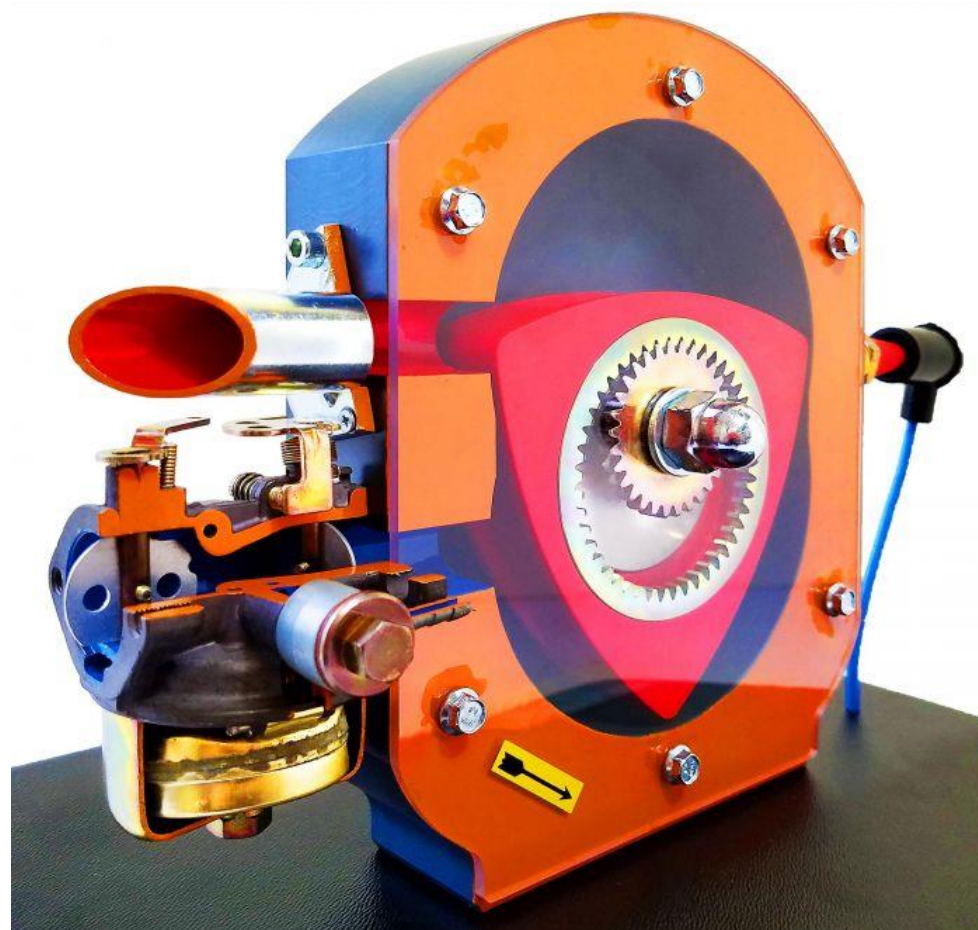


Cutaway Model: Fuel Injector

Annex-M

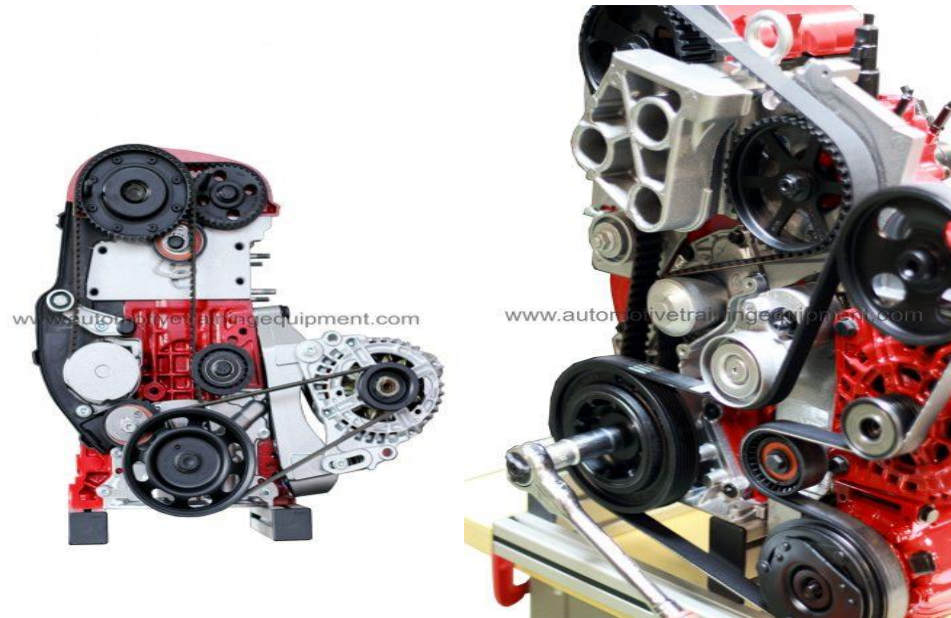


Sand Casting Unit For Spark Plugs



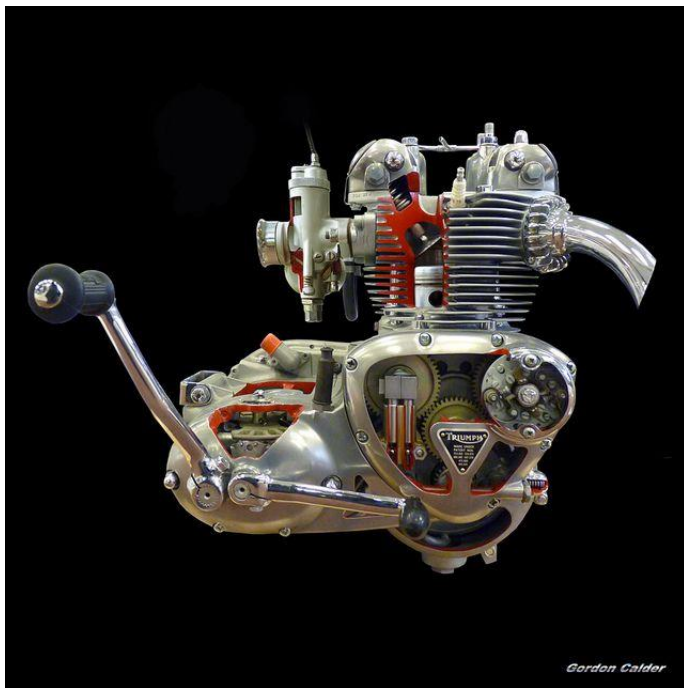
Cutaway Model: Rotary Engine

Annex-O

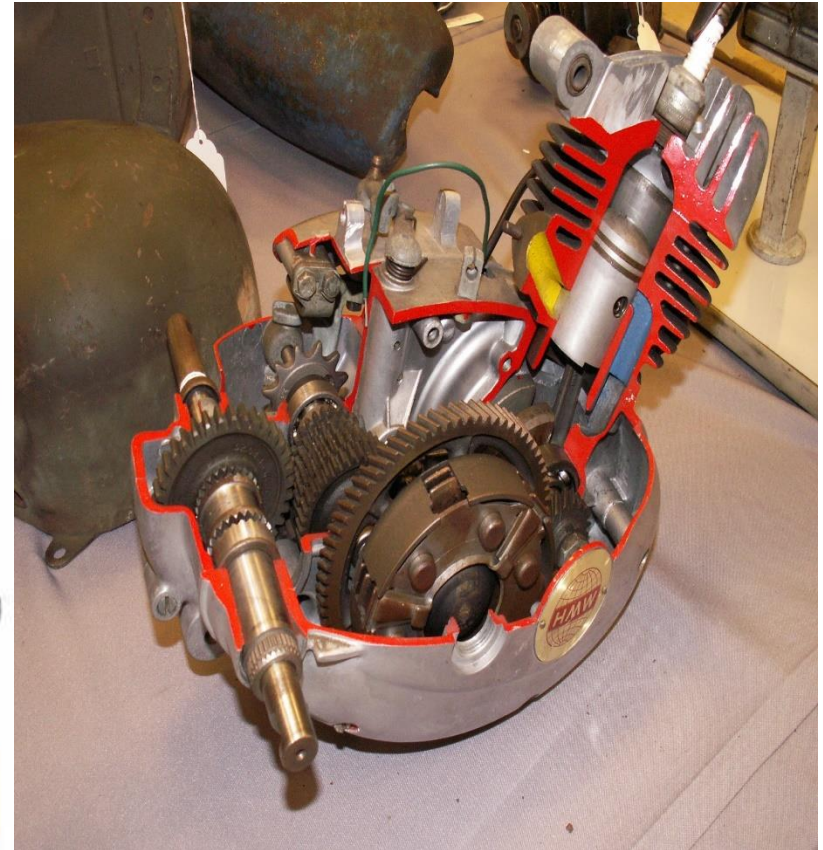


Petrol and diesel Engine cutaway

Annex-P

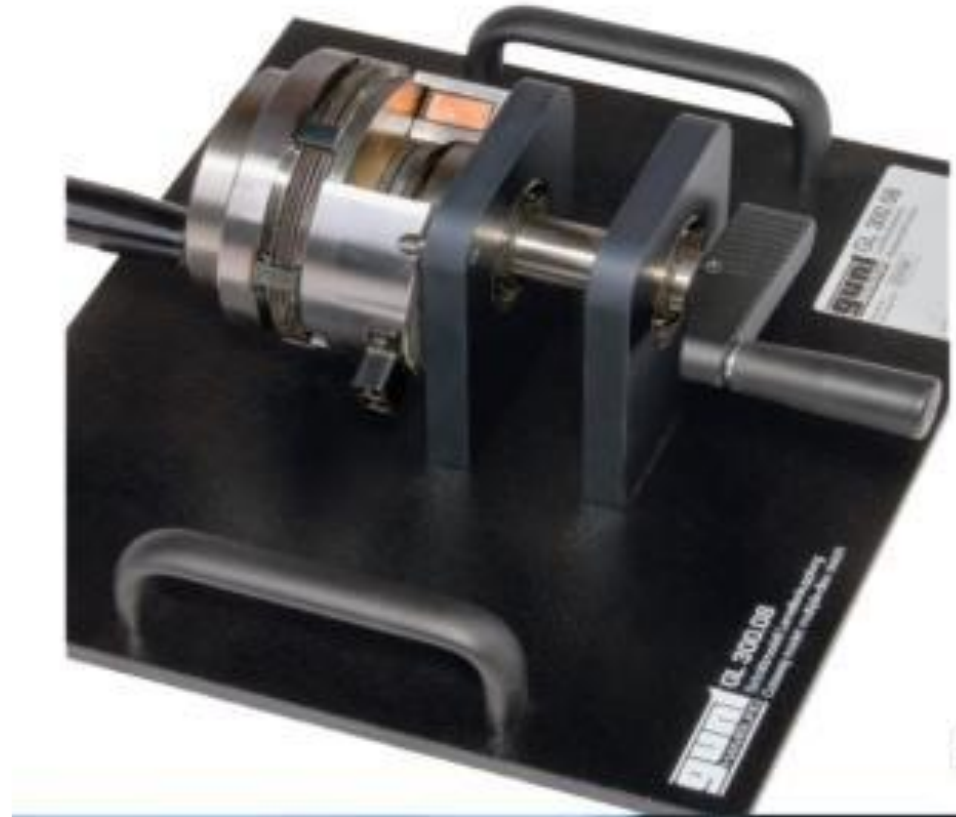


Gordon Calder

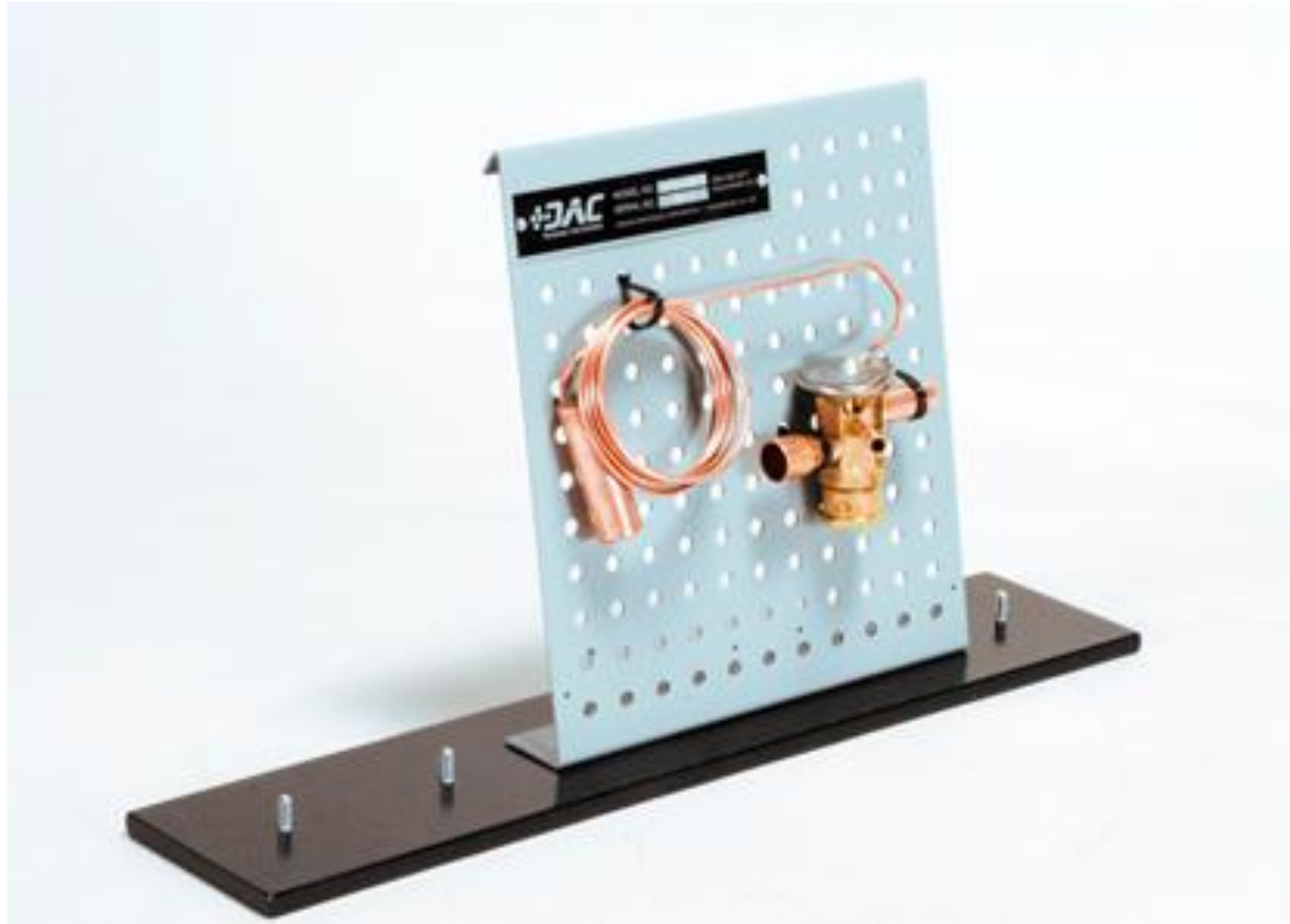


CD-70 and CG-125 Engine Cutaway Model (For Reference Only)

Annex-Q



Cutaway Model: Multiple-Disc Clutch



Cutaway Model: Thermostatic Expansion Valve

Annex-S



**For Reference
Only**

Hydraulic Brake Training Bench

Annex-T



Cutaway Model: Radial Engine

**Annex-B****TECHNICAL OFFER****NUTECH / SCM / Mechanical Lab Eqpt (PSDP) 2020 / TD-107****Fill in following essential parameters:-**

1. Validity of Offer: _____ Days (Should not be less than **90 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. 50% advance payment against BG/CDR/Pay Order/DD
2. 50 % payment 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 C**FINANCIAL OFFER****NUTECH / SCM / Mechanical Lab Eqpt (PSDP) 2020 / TD-107**

Ser	Part No	Item Name/Size	Specification	A/U	Qty Req	Price Per Unit PKR	Total Price PKR
1		Cam and Follower with DAQ system	<ul style="list-style-type: none"> ○ Bench-mounted product to analyze the dynamic characteristics of different cams and followers and their 'bounce' speed under safe and controlled conditions ○ Includes different cams, followers, springs and masses for a wide range of experiments ○ Fully interlocked for safety ○ Action principal of cam mechanism ○ A motor shaft that connects through a coupling to the main shaft. ○ Self-aligning heavy-duty bearings to support the shaft ○ 2-4 cams: arc / tangent / concave / hollow / asymmetric ○ 2-3 followers: rollers and flat face ○ 1 roller follower 14 mm radius, 0.239 kg ○ 1 flat faced follower 0.56 kg ○ Angular scale for determining the angle of rotation, 0-360° with 1° graduation ○ Stem and Indicator ○ Dial gauge for determining the stroke $D=\pm 20\text{mm}$ ○ DAQ System for capturing data and show live traces (on a computer screen) of the follower movement – even at bounce <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Generate displacement curves for cam mechanisms ○ Predictions and calculations of results for the profiles of cam and followers with respect to displacement, velocity and acceleration 	No	1		

			<ul style="list-style-type: none"> ○ Measurement of rise and fall displacement of the cam ○ Influence of different cam shapes ○ Demonstration and Measurement of stroke ○ Demonstration and Measurement of Cam bounce speeds for different cam and follower combinations 				
2		Simple Gear System	<ul style="list-style-type: none"> ○ Bench/wall mounted base unit ○ Simple and compound gear trains with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Compounded Bevel gear systems with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Simple and Compounded helical bevel gear system with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Simple and compounded worm gear system with teeth of minimum of 30, diameter of minimum of 100mm, weight of minimum of 10 kg, transmission ratio should be minimum of 10 ○ Simple rack and pinion gear system with minimum of teeth 10 on pinion and 50 on rack. Rack length should be minimum of 100mm, transmission ratio should be minimum of 10 ○ Measuring range speed: Approximately 0...600 revolutions per min <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 	No	1		

			belt, chain drive and helical gear <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 				
2a		Toothed Belt Drive Model	<ul style="list-style-type: none"> A bench mounted base unit of tooth geared model with min 3 shafts Variable speed, low-voltage motor to provide the shaft as an input turning force (effort) to the drive. A dynamometer to provide output braking force (load) to the drive Transparent cover for safety Gear teeth: ± 80 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 Annexure 'A' <u>Experimental Capabilities</u> <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 	No	1		

			<ul style="list-style-type: none"> ○ Comparison and Calculation of Mass moment of inertia of belt drive systems by calculated and experimental methods 				
2b		Round Belt Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft as an input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) to the drive ○ Transparent cover for safety ○ Gear teeth: min 80 ○ Teeth should be engaged and disengaged. ○ 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 Annexure '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	1		

2c		Chain Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) ○ to the drive ○ Transparent cover for safety ○ Gear teeth: min 80 ○ Teeth should be engaged and disengaged. ○ 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 Annexure '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 ○ 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 	No	1		
2d		Helical Gear Drive Model	<ul style="list-style-type: none"> ○ A bench mounted base unit of tooth geared model with min 3 shafts ○ Variable speed, low-voltage motor to provide the shaft input turning force (effort) to the drive. ○ A dynamometer to provide output braking force (load) ○ to the drive ○ Transparent cover for safety 	No	1		

			<ul style="list-style-type: none"> ○ Gear teeth: min 80 ○ Teeth should be engaged and disengaged. ○ 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 Annexure '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 				
3		Whitworth Quick Return Mechanism	<ul style="list-style-type: none"> ○ Investigate reciprocating motion of slider and crank ○ Show how motion is converted in quick return mechanism ○ Investigating non uniform strokes ○ Crank min radius: 40mm ○ Slider min radius: 50mm ○ Driving rod min length: 100mm ○ Measurement of stroke in cylinder ○ Stroke length: 0-120mm ○ Adjustable crank radius and crank angle at min 3 positions ○ Anodized aluminum disk and rod ○ Picture attached as Annexure 'E' <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Converting motion with the help of quick return mechanism and 	No	1		

			'Scotch yoke' (or 'slotted link') <ul style="list-style-type: none"> Investigating the revolving crank and slider Measurement of stroke in cylinder Investigation of non-uniform stroke movements Investigation of effect of crank length on output stroke Investigation of effect of input angle on output stroke Generating curves and recording data for slider crank movement Adjustment of the crank radius 				
4		Winch Mechanism	<ul style="list-style-type: none"> Investigate lift velocity and load transmission of winch Provide the parameters to calculate the efficiency and load transmission of winch mechanism Anodized aluminum frame 2 x gear wheel small and large with min 14 and 70 teeth respectively Module: min 2 Driving and driven pulleys 4 x Weights for driving and 4 x weights for driven pulleys Holders for driving and driven pulleys <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> Investigating the velocity ratios Finding hoisting velocity and force transmission Investigating transmission ratio Investigating unwinding rate Investigating angular velocity Investigating efficiency of winch Determination of behavior of winch 	No.	1		
5		Four Bar Chain	<ul style="list-style-type: none"> Investigate the mechanical relationship on four bar chain mechanism Bench mounted on kinematic behavior 	No	1		

			<ul style="list-style-type: none"> ○ Anodized aluminum discs and ball bearings ○ Anodized aluminum rods ○ 2-3 crank radii of 25mm, 37.5mm and 50mm ○ 2-3 Oscillation radii: 50mm, 100mm, 150mm, 200mm ○ 3-4 Connecting rod lengths: 50mm, 100mm, 150mm, 200mm ○ Protractor ranging 360° and 1° increment ○ Oscillating crank should be attached to a disc with its own protractor angle scale. ○ Demonstration of the operation of axle pivot steering ○ Picture attached as Annexure 'F' <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Investigating Grashof Law ○ Demonstration of mechanical relationship of four joint link ○ Investigating the principal of crank rocker mechanism ○ Investigating graphically the relationship between the angular displacements of the input crank and the output joint ○ Investigation of the principal of double rocker mechanism ○ Investigation of velocity and acceleration output of the joints ○ Graphically obtain velocity and acceleration diagrams 				
6		Slotted Link Apparatus	<ul style="list-style-type: none"> ○ Unit is to provide the demonstration of the concept and working principle of pure simple harmonic motion. ○ Disc mounted on bearing ○ Holder to join surface of bearing ○ Rotational scale on disc and can be checked at any position ○ Bar displacement should be measured at any disc angle ○ 2-3 crank radii min: 25mm, 37.5mm, 50mm ○ Cylinder stroke min: 0-100mm ○ Anodized aluminum disc and connecting rod ○ Main parts: <ul style="list-style-type: none"> ○ Scotch yoke ○ Crank and slider 	No	1		

			<ul style="list-style-type: none"> ○ Quick return mechanism ○ Picture attached as Annexure 'G' <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of action of crank and slotted link mechanism ○ Investigation the effect of crank length and input angle on output stroke ○ Demonstrate the concept and working principle of simple pure harmonic motion ○ Measurement of transmission function of crank slider ○ Measurement of stroke on the cylinder 				
7		Bench Grinder	<ul style="list-style-type: none"> ○ Cast iron base mounted unit ○ Wheel covers with in-built task lights ○ Incorporation of one eye-shield for close work ○ Induction motor for high speed material removal ○ Wheel Dia: 150-250mm ○ Hole Dia: 10-20mm ○ No load speed: 2500-4000rpm <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Should be able to grind the item it encounters ○ Shape, sharpen, buff, polish or clean the metal object 	No	2		
8		Portable Hand Drilling Machine	<ul style="list-style-type: none"> ○ 1000-2000W small electric hand drilling machine specifications. ○ Drilling dia:100-150mm ○ Rated voltage: 110V/220~240V ○ Rated frequency: 50-60HZ Rated input power: 1000-2000W ○ No-load speed:2200-2800 r/min ○ Waterproof manner: Copper tube sealing ○ Portable core drill. ○ Picture attached as Annexure 'H' 	No	4		

9		Cutaway Air Compressor 2Hp	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the compressor components, and flow paths using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Reducer with pressure gauge • Picture attached as Annexure “I” 	No	1		
10		Reciprocating Compressor (On Base) – Manual	<ul style="list-style-type: none"> ○ Trainer for recording the characteristic curve of a two-stage compressor ○ Two cylinders with V-arrangement ○ Intake vessel, with orifice meter to measure the airflow rate ○ pressure sensor and additional gauges of temperature ○ pressure gauges for analogue display ○ Intercooler between first and second stage ○ Safety valve, control valve and outlet silencer ○ power consumption: 3-5kW ○ speed: 500-1000min-1 ○ intake capacity: 200-300L/min ○ quantity delivered: 180-220L/min ○ Operating pressure: 8-13bar, max. 35bar ○ Intake vessel: 18-25L ○ Digital display of Torque, speed and power ○ Low Pressure Cylinder: Bore 90-100mm; Stroke 40-60mm ○ High Pressure Cylinder: Bore 40-60mm; Stroke 40-60mm <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Understanding different components of functions of compressor ○ Measurement of efficiencies ○ Measurement of velocities ○ Measurement of air flow rate ○ Investigation of temperature at different stages of compression 	No	1		

			<ul style="list-style-type: none"> ○ Comparison of volumetric and thermal efficiencies ○ Determination of compressor performance ○ Showing compression process on P-V diagram 				
11		Cutaway Model: Carburetor	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the carburetor components using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "J" 	No	1		
12		Cutaway Model: Fuel Injection Pump	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the pump components, and flow paths using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "K" 	No	1		
13		Cutaway Model: Fuel Injectors	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the fuel injector components using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "L" 	No	1		
14		Tool Kit 142 Tools or more	<ul style="list-style-type: none"> ○ 1/2 inches Hexagonal Socket, Star Socket, Dr. Flex handle, ratchet wrench, Extension bar, dr Universal joint, Spark plug socket ○ 1/2 inches (F) x 3/8 inches (M) three way adaptor ○ 1/2 inches x 10 inches L handle ○ 3/8 inches, 12 pt. socket, ratchet wrench, Extension bar, dr Universal joint ○ 1/4 inches x 25 mm Bit socket ○ Bit Holder ○ 1/4 inches Hexagonal Socket, Star Socket, ratchet wrench, Extension bar, dr. universal joint ○ 3/8 inches(F) x 1/4 inches (M) three way adaptor 	No	3		

			<ul style="list-style-type: none"> ○ 1/4 inches x 150 mm Spinner handle ○ 1/4 inches x 150 mm Flexible extension bar ○ Combination spanner ○ Flare nut spanner ○ Hex key ○ 300 g Machinist hammer ○ 7 inches Combination Pliers ○ 10 inches Curved jaw lock wrench ○ S2 Slotted, Phillips screwdriver ○ Stubby screwdriver 				
15		Sand Casting Unit For Spark Plugs	<ul style="list-style-type: none"> ○ Unit should be bench mounted ○ Frame of unit should be metal based but aluminum based would be preferred ○ Cleaning of the spark plugs should be based on sand blasting mechanisms ○ Picture attached in annex "M" <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of the cleaning of spark plugs ○ Demonstration of spark plug effectiveness after sand blasting 	No	1		
16		Spark Plugs Of All Types	<ul style="list-style-type: none"> ○ Spark plugs containing: ○ flash ribs ○ insulator ○ caulking ○ hex ○ shell ○ gasket ○ thread ○ center electrode ○ ground electrode ○ copper core ○ insulator tip 	No	25		

			<ul style="list-style-type: none"> ○ Copper/Nickel spark plugs ○ Single Platinum spark plugs ○ Double Platinum spark plugs ○ Iridium spark plugs ○ Silver spark plugs ○ Gapping spark plugs 				
17		Cutaway Model: Rotary Engine	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the engine components using contrast colors ○ Light metal construction. ○ Operated manually by a crank handle ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "N" 	No	1		
18		Cutaway Model: 2 Stroke, 4 Stroke Petrol And Diesel Engines	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the engines using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "O" 	No	1		
19		Cutaway Model: Cd-70 And Cg-125 Engine, Transmission And Complete Chassis Model	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the engine components, and flow paths using contrast colors ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Picture attached in annex "P" 	No	1		
20		Air Compressor (On Base) - Manual	<ul style="list-style-type: none"> ○ Investigating intake and delivery pressure airflow rate compressor ○ Two cylinders ○ Air flow rate sensor ○ Pressure sensor ○ Temperature sensor ○ Speed control sensor ○ Manometers ○ Inlet and outlet silencers 	No	1		

			<ul style="list-style-type: none"> ○ Safety valve ○ Control valve ○ Clean, dry air ○ Pressure: 5-15 bar ○ Air connection: 3/4" ○ Intake vessel ○ Pressure vessel <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration and availability of pressurized air ○ Air pressure comparison over screw and reciprocating compressors 				
21		Multi Disc Clutch Cutaway	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the components, internal surfaces, using contrast colors. ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Pic attached at Annex 'Q' 	No	1		
22		Thermostatic Expansion Valve Cutaway	<ul style="list-style-type: none"> ○ Sectioning of actual hardware. ○ Color-coding of the valve components valve body, internal surfaces, seat, and closure devices using contrast colors. ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Pic attached at Annex 'R' 	No	1		
23		Screw Compressor (On Base) – Manual	<ul style="list-style-type: none"> ○ Screw Type Air Compressor unit capable of continuously supplying compressed air ○ Powered by a 3 phase A.C. electric motor ○ Receiver Tank ○ Safety Valves ○ Pressure gauge ○ Pressure Relief Valve, ○ Automatic Pressure Switch, ○ Suction Filter, ○ Oil Sight Glass, 	No	1		

			<ul style="list-style-type: none"> ○ Drain Valve, ○ Non Return Valve, ○ Starter for the motor. ○ Air delivery : 50-80 CFM ○ Receiver Air tank capacity: 500 litres minimum. <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of air pressure ○ Demonstration and comparison of air pressure using screw compressors over manual air compressors 				
24		Hydraulic Brake Training Bench	<ul style="list-style-type: none"> ○ Model should be mounted on suitable metal frame with dimensions ○ Unit should consist of minimum of two sets of hydraulics brakes ○ Pressure distribution systems to brakes should be visible to students ○ Pressure sensors/meters should be places to acquire the actual hydraulic pressures to brakes ○ Motor for driving the wheels to from 0...300 revolutions per min ○ Pic attached at Annex 'S' <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of pressure applying on disc brakes ○ Demonstration and predictions of disc brakes effects over high speeds ○ Demonstration of frictional effects over disc brakes ○ Hydraulic pressure applying on brakes 	No	1		
25		Electrical Wiring Trainer	<ul style="list-style-type: none"> ○ Low voltage pushbutton "doorbell" switch ○ Pilot light to indicate low voltage "ON" ○ A low voltage buzzer ○ Two standard duplex receptacles ○ GFI duplex receptacles ○ Two lamp sockets ○ Pilot light to indicate 120 VAC is "ON" 	No	1		

			<ul style="list-style-type: none"> ○ Two three-way toggle light switches ○ Standard residential 4 circuit breaker panel ○ Dual 24 VAC, 5 Amp pre-test panel with breaker ○ Three wire grounding AC 120V cord ○ Starter quantity of wire for trainer <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Demonstration of residential wiring demonstrator ○ Demonstration of wiring and electrical distribution ○ Wiring instructions along with practice text ○ Demonstration of wiring needs over different areas and requirements with respect to current 				
26		Air-Fuel Mixture Measuring Apparatus	<ul style="list-style-type: none"> ○ Portable air fuel mixture testing unit ○ Measure the air fuel ratio of car/motorcycle in a running conditions ○ Unit should be operate-able on petrol engines ○ Identify and set the proportions of petrol fuel and air quantity before entering into the combustion chamber <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> ○ Analysis of air-fuel ratios in petrol engine over throttling conditions ○ Calculations of optimum air-fuel ratios for a petrol engine 	No	1		
27		Cutaway Model: Radial Engine	<ul style="list-style-type: none"> ○ Model should be mounted on suitable base of wood or metal approximately 4-6 inches high. ○ Pic attached at Annex 'T' 	No	1		
28		Hooks Universal Joint	<ul style="list-style-type: none"> ● Bench Mounted Unit ● Universal Joints minimum set of 2 ● Connecting shaft should be of stainless/steel ● 360 degree marked disks minimum of two for measuring the angle of rotations ● Universal joint connected columns should be mounted on disk 	No	1		

			<p>with two disks marked with 360 degree rotations</p> <ul style="list-style-type: none"> • End columns should be connected with ball bearings (minimum of 2) for smooth rotations <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Calculations of gimbal error • Demonstration of powers to automotive wheels • Demonstration of knuckle joints • Calculate the relative displacements of the shafts at opposite ends of a single and double Hooke's Joint. • To observe the effect of changing the angles between the axis of the coupling(s) and shaft on the relative angular shaft displacements 				
29		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, • Stand should be compatible with geared system, flywheel systems, belt drive units and chain drive units, <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Calculations of moment of inertia of geared systems • 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 	No	1		

			<ul style="list-style-type: none"> 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 				
30		Belt Friction Apparatus	<ul style="list-style-type: none"> Standalone unit for demonstrating advantages and disadvantages of three popular drive systems: belt, chain and a universal coupling, with a rotating frame with a low-friction cantilever linkages, adjustable masses and a spring to apply force Extra parts to demonstrate the importance of angle of lap around a pulley and its relationship with friction Must include Chain drive, Belt drive, Universal coupling and Weight hangers and weights <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> Power transfer, efficiency and direction in a belt drive Power transfer and efficiency in a chain drive Input and output relationships of a universal coupling Friction and angle of lap on a pulley 	No	1		
31		Ackermann Steering Demonstrator	<ul style="list-style-type: none"> Anodized aluminum frame and panels made of painted steel. Diagram in the front panel with distribution of the elements similar to the real one. The unit includes: <ul style="list-style-type: none"> Two levers made of aluminum. An intermediate steering rod made of aluminum. Two track rods, with individual length adjustable by an adjustment nut. 	No	1		

		<ul style="list-style-type: none"> ○ Two pivots. ○ Two indicators to measure the steering angle. ○ Two graduated discs for angle displacement. Measuring range of the steering angle: $\pm 50^\circ$. Scale graduation: 1°. <p><u>Experimental Capabilities</u></p> <ul style="list-style-type: none"> • Demonstrate and verifying the Ackermann's steering principle and determination of the lead angle of a steering trapezoid • Calculate the wheelbase drive systems and the influence of the track rod length • Determine the lead angle and the steering error • Determining the variation on turns caused by track maladjustment. 				
		Total				

Firm Name: _____

Signature: _____

Name: _____

Designation: _____

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.

BANK GUARANTEE AGAINST
"ADVANCE/PERFORMANCE/WARRANTY GUARANTEE
Which ever is applicable

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 Advance/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"

(To be provided on stamp paper)

Contract No: _____

Dated: _____

Validity 2 years from the date of final acceptance of the Stores.

1. 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.
2. 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.
3. The Warranty shall remain valid for a period of 2 years from the date of final acceptance of the Stores.

Signature_____

Name_____

Desig_____

Stamp_____

Date_____

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	Quoted Currency as per IT	Yes	No
6	Accounting unit/Qty as per IT	Yes	No
7	Delivery Schedule as per IT	Yes	No
8	Country of origin of store _____		
9	Name of OEM:- _____		
10	Original Performa invoice (Mandatory)	Yes	No
11	Certified that there is no Deviation from IT conditions/ there is deviation from IT condition as per fol details	Yes	No
12	Blacklisting certificate.	Yes	No
13	Verifiable OEM Certificate	Yes	No
14	Warranty Period as per IT	Yes	No
15	ATPs provided	Yes	No

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

Signature of Firm Auth Signatory