Request for Proposal

for Setting up of

Centre of Excellence

In

Manufacturing and Automation

(Industry Linked Skill Development Initiative)

at

PEC University of Technology, Chandigarh

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1.   About PEC University of Technology, Chandigarh

The PEC University of Technology, Chandigarh was originally established as Mugalpura Engineering College at Lahore (now in Pakistan) on November 9, 1921. The name of the college was later changed to Maclagan Engineering College and it started functioning under the name on March 19, 1924. In the year 1931, the college was affiliated to Punjab University, Lahore. After partition in 1947, the college was shifted to Roorkee (India) and was renamed as East Punjab College of Engineering. In the year 1950 the word east was dropped and it came to be known by its new name – Punjab Engineering College. Towards the end of December 1953, the college shifted to its present campus in Chandigarh to function under Govt. of Punjab. In 1966, with the formation of Union Territory of Chandigarh, the college came under the control of Govt. of India through Chandigarh Administration. In October 2003, the Govt. of India notified the Punjab Engineering College as a Deemed to be University and thereafter it became known as Punjab Engineering College (Deemed University). In 2009, the Board of Governors renamed the institution as PEC University of Technology.

In 1994, this institution was adjudged the best technical college in India by the National Foundation of Engineers. It occupies an area of 146 acres. Up to 1962, the college consisted of engineering departments of Civil, Electrical and Mechanical Engineering. Thereafter the college expanded and five new departments in the fields of Aeronautical Engineering, Electronics and Electrical Communication Engineering, Metallurgical Engineering, Production Engineering and Computer Science Engineering were added gradually. In the year 1957, Highways Engineering was added as the first post-graduate course in the college. Gradually, more post-graduate courses were added. Presently there are 14 post-graduate courses leading to Masters of Technology degree in Transportation, Structures, Water Resources, Mechanical, Electrical, Electronics, Electronics (VLSI Design), Computer Science & Engineering, Computer Science & Engineering (Information Secutiry), Environmental Engineering (Interdisciplinary), Total Quality Management (Interdisciplinary), Industrial Design (Interdisciplinary), Industrial Materials & Metallurgical Engineering and Production & Industrial Engineering. Facilities for post-graduate studies exist for regular as well as for part-time students. The college has facilities for research work leading to the award of Ph.D. degree in engineering in certain selected fields of different disciplines. The college also offers consultancy services in different disciplines.

The college has a total of 667 seats in 8 B. Tech. programmes & 287 seats in 14 M. Tech. programmes, in addition to the part-time programmes available in various streams.

2.   Background note on project :

PEC University of Technology, Chandigarh initiated the proposal for Establishment of Centre of Excellence through M/S Siemens. The entire set of requirements, quantities etc. have been worked out.

By competent authority it has been decided to float the RFP through Swiss Challenge method of tendering /procurement. Accordingly, the present RFP is in place with first right of acceptance reserved with M/S Siemens.

The proposal / bid can be submitted based on the bill of materials mentioned under Para 7 or at par with the same.

3. Procedure :

The bids shall be processed in three parts :

Part A	Fulfilment of eligibility criteria by the bidders as stipulated in Para No. 8.
Part B	The detailed project report submitted by the bidders shall be evaluated by the committee constituted by the Board of Governors of PEC. The prospective authorized bidders may be invited to make presentation before the committee.
Part C	The bidders who are declared eligible shall be entitled for opening of their financial bid(s). The lowest bidder's bid shall be offered to M/s Siemens and in case the same is matched by M/S Siemens, the project shall be executed by M/S Siemens; otherwise the project shall go to the lowest bidder.

Earnest Money Deposit (EMD) (Refundable)	Rs. 16 Lacs	In the form of A/c Payee DD / FDR / Banker's cheque which shall remain valid for a period of 40 days beyond the financial bid validity period.
Performance Security	5% of the total value of bid / contract	In the form of A/c Payee DD / FDR / Bank Guarantee from a commercial bank which shall remain valid for a period of 60 days beyond the date of completion of all contractual obligations of the supplier including warranty obligations.

Calendar of events :

Date of floating of RFP	04/01/2017
Pre-bid meeting for discussions / clarifications (if any)*	20/01/2017
Loading of amendments (if any) by PEC	23/01/2017
Last date of Submission of Proposal / Bid	06/02/2017
Checking of eligibility criteria	10/02/2017
Publishing of the list of qualified bidders on institute website	13/02/2017
Opening of technical bids of eligible bidders	13/02/2017

Presentation by selected bidders	20/02/2017
Opening of financial bids of shortlisted bidders	23/02/2017
Closure of RFP	28/02/2017

* Only bidders who pay the requisite fees of tender documents shall be allowed to participate in the pre-bid meeting.

4. Project Overview and objectives:

The idea of setting up of Industry Linked Centre of Excellence in Manufacturing and Automation (CoE) originated from the need to align the engineering education with the latest industry trends and practices, better vocational training / interaction with industry, upgradation of tools, laboratories and faculty skills as well as the inclusion of latest engineering concepts into the academic curriculum structure.

Objectives:

- Bridge the gap between Industry needs and the available set of skills through Industry oriented learning.
- Enable PEC to improve the quality of technical education & training in the region.
- Provide state-of-the-art tools to match industry standards.
- Student Training on live projects from the Industry.
- Availability of learning modules with learner centric study material.
- Reduce investment of time, effort and money by the industry in the training of the students.
- Improve student employability.
- Improve industry competitiveness globally.

Expected Outcomes:

- Establish a state-of-art Centre of Excellence at PEC.
- A complete learning solution that will build specific skills set and equip students with employable skills in manufacturing and allied sectors.
- Improved faculty & staff competency at PEC.
- Promote Industry-academia partnership.
- Updated technical education curriculum that is more aligned with industry needs.
- Improved employability which is mutually beneficial to the students proposed to be trained as well as the industry.
- Vocational training for skill enhancement of the youth of the region.
- Impart training to the faculty and students of Chandigarh Region Innovation & Knowledge Cluster (CRIKC) institutes, which include all the constituent and affiliating colleges under Panjab University and the nearby research laboratories like CSIO and TBRL.
- Impart training to the faculty and students of other engineering institutes/ ITI's and Polytechnics in Chandigarh region.

5. Laboratories to be set up under COE

a) DESIGN AND VALIDATION LAB

In this Lab, the design engineers design the products and validate the design to ensure that they can be manufactured without any defects and failures. The Design and Validation Lab consists of the solution for Computer Aided Design (CAD) and Computer Aided Engineering (CAE). These solutions assist the students to understand engineering design and analysis. The scope of this lab should include live industry projects from Automotive, Aerospace, Industrial Machinery & Renewable Energy Industry segments.

b) ADVANCED MANUFACTURING LAB

The Advanced Manufacturing Lab consists of the Computer Aided Manufacturing (CAM) which enables candidates to learn how to create CNC Programs and validate the Machine Tool cutting operations and parameters; and Digital Manufacturing Solutions which assist the candidates to understand manufacturing planning and validation. The lab also consists of the Product Lifecycle Management Solution which allows the candidates to learn the enterprise solutions of product development from end to end.

c) AUTOMATION LAB

The Automation Lab allows the candidates to understand the requirement and functioning of Programmable Logic Controllers (PLCs). This is the first step toward Internet of Things (IOT). Here the candidates learn how to Program Industrial PLCs, work with Industrial Human Machine Interface (HMI), Industrial SCADA (Supervisory Control & Distributed Acquisition) and PLC networking using Profibus and Profinet.

d) ELECTRICAL & ENERGY SAVING LAB

The Electrical lab allows the students to understand the requirements, power electronics & controls functioning of Industrial AC-DC Drives & PLC networking using Profibus and Profinet. Apart from this students would get to understand the requirement and functioning of Industrial Switchgear (LV), Power Distribution, Quality & Measurement. There would also be a course on Induction Motor (Service/ Maintenance).

e) MECHATRONICS LAB

The Mechatronics lab brings together 4 departments of engineering, namely Mechanical, Electrical, Electronics & Communication and Computer Science. This allows students to work on a mini factory like setup and on areas such as Pneumatics & Hydraulics, Sensors, Communication Protocol, PLC programming and Networking.

f) PROCESS INSTRUMENTATION LAB

The Process Instrumentation Lab enables students to work on Advance Automation using Distributed Control Systems (DCS) and understanding the working of the following equipment's in a plant:

- Temperature
- Flow
- Level
- Pressure
- Sensors/Measurements & Communications

g) TEST AND OPTIMIZATION LAB

The Test and Optimization Lab addresses complex engineering challenges safeguarding the balance between technological design options and functional performance. From testing and mechanical simulation to model-based systems engineering it enables students to understand the functional performance engineering of mechatronic systems to solve noise, vibration and harshness (NVH), acoustics, durability, dynamics, performance, fuel economy and controls development issues.

The Test and Optimization Lab includes:

- Imagine Lab
- Virtual Lab
- Test Lab

h) CNC CONTROLLER LAB

The CNC Controller Lab enables students to understand the concept of CNC Programming and work real Sinumerik 808D controller for Turning and Milling applications. The students will also get to work on the Sinumerik 840 Dsl rack which supports programming upto 31 Axis. This would enable students to program complex jobs. The students can learn how to program and test the CNC Program using the Sinutrain software.

i) CNC MACHINE LAB

The Logical step after learning CNC Programming would be to execute the CNC Program on an industrial CNC Machine. The CNC Machine Lab consists of two industrial grade CNC Machines with inline inspection facility:

- CNC Lathe
- Vertical Machining Centre

j) ROBOTICS LAB

Robots play an important role in the manufacturing industry, ensuring that the quality of the product is not compromised and the production volumes are met. In the Robotics Lab we would teaching the students to understand the working principals of a Robot, how to program it and apply it to an application. There would be three (3) robotics cells catering different applications, they are:

- Pick and Place Robotic Cell Spot
- Welding Robotic Cell
- MIG Welding Robotic Cell

k) RAPID PROTOTYPING LAB

Rapid prototyping is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data. Construction of the part or assembly is usually done using 3D printing or "additive layer manufacturing" technology.

This is a fast emerging technology which is finding its way into manufacturing addressing various industries. In the Rapid Prototyping (RPT) Lab, the students will be trained on how to design and manufacture using the RPT Machine.

l) METROLOGY LAB

Metrology is the science of measurement. Metrology includes all theoretical and practical aspects of measurement. Quality is an important aspect of the manufacturing Industry in India and globally today. In the Metrology Lab we focus on quality measurement using the Coordinate Measuring Machine (CMM) and some of the advance digital measuring gages.

m) RENEWABLE ENERGY LAB

There is a growing requirement of energy in India and globally. By using renewable energy sources like solar energy, we also reduce our dependence on fossil fuel gas and oil reserves, which are becoming more expensive and difficult to find. In order to meet this growing demand, more and more Organizations and Governments are moving towards Renewable Energy for the purpose of training of candidates.

The Renewable Energy Lab enables the students to understand how Renewable energy can be generated, stored and transmitted. In the lab we cover two renewable energy sources:

- Solar Energy
- Wind Energy

n)   INTERNET OF THINGS (IOT) LAB

The Internet of Things, or IoT, is emerging as the next technology mega-trend, with repercussions across the business spectrum. By connecting to the Internet billions of everyday devices – ranging from fitness bracelets to industrial equipment – the IoT merges the physical and online worlds, opening up a host of new opportunities and challenges for companies, governments and consumers.

In order to meet the growing demand of IOT in the industrial or manufacturing segment we cover the following topics for the students in the Internet of Things (IOT) Lab:

- Connecting Things
- Data Analytics
- Application Development
- Enterprise Development

6.   Scope of Engagement

(a) Scope of Engagement under Skill Development

1. Setting up of Centre of Excellence in Manufacturing Automation & allied areas consisting of the above labs.

2. Providing Master trainers / faculty and skilled manpower to run the laboratories for a period of 3 years.

3. Training of Trainers (deputed by PEC) by bidder for one year through Master trainers to make them fully competent to independently run the CoE at the end of 3 years.

4. Full responsibility for running the operations of Centre of Excellence for 2 years, followed by 1 year of handholding for smooth transition.

5. Maintenance of software and hardware and provision of software upgrades for at least the period of 3 years from the successful commissioning of the CoE. However, software upgrades and support will be provided even after the period of 3 years.

(b) Scope of Work under Learning Program

1. Provision of training modules & providing IT enabled course material.

2. Enrolling candidates for training courses.

3. Training of candidates.

4. Continuous evaluation of candidates.

5. Certification of the candidates upon successful completion of training.

6. Conducting Seminars, Conferences, Workshops, Industry Conclaves, Industry Surveys, Industry meetings, Creating awareness or organising placement activities, Entrepreneurship development, supporting start up ecosystem, prototypes development, Assistance in R&D activities.

(c) Scope of work under PEC

1. Physical Infrastructure to be provided by PEC#
   - Space for Labs including related civil works as required.
   - Flooring, Furniture and Fixtures
   - Air Conditioning
   - LAN connectivity
   - Power supply (including Backup)
   - Generator/ UPS Backup
   - Compressor for the labs
   - Water
   - Running expenses for utilities
   - Security (Manned/ CCTV)

2. Providing nodal person for the CoE and requisite faculty for the laboratories

   #**NOTE:** The requirements for the above work, however, need to be specified by the successful bidder.

7. Bill of Materials for Centre of Excellence

Important: The Bill of Materials offered by the bidder may be equivalent or at par with that of M/s Siemens as listed below:

S. No.	Particulars	Units
Product Design and Validation Lab & Advanced Manufacturing Lab		
1.	Siemens Digital Product Design Suite	30
2.	Siemens Digital Simulation & Validation Suite	30
3.	Siemens Digital Manufacturing, Robotics & Automation Suite	30
4.	Siemens Digital Manufacturing Plant Simulation & Optimization Suite	30
5.	Siemens Digital Lifecycle Management & Collaboration Suite	30
Automation Lab		
6.	Simatic S7 1200 PLC with HMI (6 Kits Package)	1
7.	Simatic S7 1500 PLC with HMI (1 kit Package)	1
8.	Software - TIA Portal Simatic Manager V13- 12 user/ TIA Portal WinCC V13- 6 user	1
ELECTRICAL & ENERGY SAVING LAB		
9.	SINAMICS G120 for 3 AC 400V Standard drives (1 kit Package)	5
10.	DC Drive - 6RA80	2
11.	Demo case for L V Switchgear set (Multiple items) consisting of : Star-Delta Starter training kit Soft starter training kit ACB 3WL MCCB training kit Type II Coordination Training kit	1
12.	Demo case for L V Motor set (Multiple items)	1
13.	SIMOCODE	2
14.	PAC METER	6
15.	Energy Savings Training Kit	4
PROCESS INSTRUMENTATION LAB		
16.	PCS 7 Trainer Package - 6 Licenses	1
17.	Simatic PCS-7 - AUTOMATION SYSTEM	2
18.	Process Instrumentation (Multiple Instruments)	1
MECHATRONICS LAB		
19.	Mechatronics Training kit consisting of: MMS (Mechatronics Modular System) consisting of : Feeder Station, Inspection Station, Buffer Station, Processing Station, Sorting Station , Silent Compressor, Tool kit, SIMATIC S7-1200 PLC with Analogue Input, TIA Portal Simatic Manager Version-13 (basic) License 4 Work Bench (with Tool Box, Compressor) with S7-1200 PLC and TIA Portal Simatic Manager Version-13 (basic) License	1
Test and Optimisation Lab		
20.	Siemens LMS Virtual Lab	15
21.	Siemens LMS Imagine Lab	15

22.	Samtech	15
23.	Siemens LMS Test. Lab	1
Machine Lab		
24.	Siemens Sinumerik 828D – Milling Controller	2
25.	Siemens Sinumerik 828D – Turning Controller	2
26.	Siemens Sinumerik 840D-SL CNC Training Rack	1
27.	Siemens Sinutrain Licenses	18
28.	Rapid Prototyping Unit	1
29.	CNC Turning Centre	1
30.	CNC Vertical Milling Machine	1
31.	Robotic Pick and Place Cell	1
32.	Robotic Spot Welding Cell	1
33.	Robotic MIG Welding Cell	1
Metrology Lab		
34.	Coordinate Measuring Machine (CMM)	1
35.	Advance Quality Digital Gauges (Multiple Equipment)	1 set
Renewable Energy Lab		
36.	SOLAR ENERGY TRAINING SYSTEM (CUSTOMISED 8010-5)	1
37.	WIND ENERGY TRAINING SYSTEM (CUSTOMISED 8010-5)	1
38.	WIND ENERGY TRAINING SYSTEM (CUSTOMISED 46120-0A)	1
39.	HOME ENERGY (SOLAR & WIND) TRAINING SYSTEM (46120-OA)	1
Internet of Things (IOT) Lab		
40.	Datonis for On-Field Applications	1
41.	Datonis for Shop Floor Applications	1
42.	Certified Hardware (Data Collection)	1
43.	Datonis Gateway	1
44.	OPC Server License	1
45.	Adopter	1

NOTE: For detailed specifications of the Bill of Materials, please see Annexure-I.

7.1. Number of Computers required per Lab

S. No.	Lab	No. Of Computers
1	Design & Validation Lab	30
2	Advanced Manufacturing Lab	30
3	Automation Lab	8
4	Mechatronics Lab	6
5	Process Instrumentation Lab	6
6	Test and Optimisation Lab	16
7	Metrology Lab	1
8	Renewable Energy Lab	24
9	Internet of Things Lab	24
10	CNC Controller Lab	10
11	CNC Machine Lab	1
12	Robotics Lab	3

13	Rapid Prototyping Lab	1
14	DIAS Lab	40
TOTAL		**200**

7.2. Specifications of Computer Workstation

S. No.	Specifications
1	Microsoft Windows 7 Professional Edition 64bit OS
2	Intel Xeon E3-1225v2 3.2 GHz (up to 3.6 GHz) 8MB 77W GT2 4C CPU
3	16GB DDR3-1600 nECC (4x4GB) Unbuffered RAM
4	500GB 7200 RPM SATA 6G 1st Hard Drive
5	16X SuperMulti DVDRW SATA 1st ODD
6	USB Keyboard & PS/2 Mouse
7	NVIDIA Quadro K600 2GB DL-DVI(I)+DP 1st No cables included Graphics
8	18.5 inch TFT Monitor

NOTE: Computer Hardware will be procured from and serviced by globally recognized brands like HP, DELL, IBM, Lenovo etc.

8. Eligibility
The prospective vendor / service provider must meet the following minimum eligibility criteria:

- Must have been in business at least for the last 5 years.
- Must have carried out similar / relevant activities for at least last 3 years.
- Minimum turnover of 50 crores per year for the last 3 consecutive years.
- Must have carried out minimum 2 sets of installations and successful commissioning of similar facilities in R&D / academic institutes of higher learning globally (preferably one installation in India) during the last 3 years which can be demonstrated.
- Must have experience of similar / equivalent integrated work of laboratories including ICT, Hardware, Software, Digital Learning solution, live Industry Environment involving Mechanical, Electrical, Electronics and Computer Science departments.
- Must be an OEM / System Integrator of large global companies like Fanuc, Mitsubishi, Siemens, Fujitsu, GE, ABB, Panasonic, Kuka or any other reputed company.
- Must possess Intellectual Property Rights for software's learning material, Digital Content etc. wherever applicable.
- Must have hand holding team and trained Master trainers who will be deputed for period of 3 years.
- Must be capable of undertaking installations of all the labs as a turnkey project (partial offer for selective labs will not be accepted).
- The bill of materials contained in the bid should be equivalent or at par with that of M/s Siemens.

9. General Terms and Conditions :

- Due Date: Proposals must be received not later than 06.02.2017 at 4.00 P.M. in the office of Registrar, PEC University of Technology, Chandigarh-160011, India.
- In order to be considered for the award, all packages must be received at the appropriate location by the required time. Any package not received on time at the noted location may be rejected.
- Vendor(s) shall include a complete description of all products and services offered in their Proposal.
- All products shall be new and of first quality.
- All Vendors must provide any/all warranty information whether it is expressed or implied for specific products at the time of delivery.
- Training: Comprehensive ordering system training programs and packages shall be provided, at no additional cost to the University, by the Vendor and made available as needed to ensure that all the nominated University personnel are properly trained.
- All products shall be shipped FOB Destination, at the awarded Vendor's expense. All items shall be at the Vendor's risk until they have been delivered and accepted by the receiving entity. All items shall be subject to inspection on delivery. Hidden damage will remain the responsibility of the Prospective Bidder to remedy without cost to the University; regardless of when the hidden damage is discovered. Prospective Bidders are responsible for filing and expediting all freight claims with the carrier.
- Delivery costs are the responsibility of the awarded vendor.
- If special delivery or handling charges are applicable they shall be pre-approved by the order initiator.
- The vendor will arrange for the return of all erroneously ordered or shipped items at no cost to the University. There will be no restocking fee for return of items that are damaged or shipped by the vendor in error.
- The University reserves the right to terminate the awarded vendor's services for cause at any time during the term of the contract.
- The awarded vendor may not assign, sell or sub-contract its obligations under the contract to any third party without prior written approval of the University.
- In the event that the contract is terminated either by contract expiration or by voluntary termination by the University, the vendor must continue all services until new services become completely operational.
- All equipments must be delivered, installed and commissioned within a maximum period of 6 months from the date of placement of order.

10. Contact Details:

1. Prof. Dina Nath,
   Head, Workshop & Skill Development Centre,
   PEC University of Technology, Chandigarh-160011, India.
   Email ID: dinanath@pec.ac.in, Phone No: 0172- 2753585

2. Dr. Sanjeev Kumar,
   Associate Professor, Mechanical Engineering Department,
   PEC University of Technology, Chandigarh-160011, India.
   Email ID: skthakkarpec@yahoo.com, Phone No: 0172- 2753564

Note:

- All queries may be submitted via email with the subject heading: "Setting up of Industry Linked Centre of Excellence in Manufacturing and Automation".
- Queries should be sent to the above said Email IDs only.

11. Proposal Page :

The undersigned proposer, in response to PEC University of Technology's Request for Proposal "Setting up of Industry Linked Centre of Excellence" having carefully examined the proposal documents and being familiar with the conditions surrounding the proposed project, hereby proposes to provide such products and services, meeting the requirements outlined in this RFP, in accordance with the proposal attached hereto.

Proposer's Name & Title	
Vendor Name	
Address	
Phone	
E-mail	
No. of years in business	
No. of years of experience in carrying out relevant / similar business	
Turnover for the last 5 years	
Details of similar installations commissioned and operated successfully	

Proposer's Signature:

Please submit adequate, appropriate admissible self attested document in support of your claim.

1. **List of Software Modules in NX Academic Bundle**

S. No.	Module Code	Particulars
1	NX13210	NX Mach 3 Progressive Die Design
2	NX13510	NX Advanced Simulation - Add On
3	NX30101	NX Knowledge Fusion Author
4	NX30106	NX Open Toolkits Author
5	NX30107	NX Open GRIP Author
6	NX30108	NX Body Design
7	NX30109	NX General Packaging
8	NX30113	NX Human Modelling
9	NX30114	NX Human Modelling Posture Prediction
10	NX30117	NX Aerospace Sheet Metal
11	NX30122	NX Weld Assistant
12	NX30123	NX Electrode Design
13	NX30127	NX WAVE Control
14	NX30130	NX DraftingPlus
15	NX30133	NX Issue Management
16	NX30138	NX Integration to Geolus
17	NX30140	HD3D Visual Reporting
18	NX30142	NX Ship Design
19	NX30145	NX Ship Structure Detail Design
20	NX30146	NX Ship Structure Manufacturing Prep
21	NX30148	NX Routing HVAC
22	NX30149	NX Routing P&ID
23	NX30150	NX Rules Based Structure Welding
24	NX30151	NX Ship Drafting
25	NX30153	NX Routing Cabling
26	NX30154	NX Routing Base
27	NX30200	NX Mold Wizard
28	NX30202	NX Die Structure Design
29	NX30203	NX Die Engineering
30	NX30409	NX 5 Axis Machining Add-on
31	NX30411	NX 3 to 5 Axis Milling Add-on
32	NX30431	NX Wire EDM Add-on
33	NX30432	NX 2.5 Axis Milling Add-on

S. No.	Module Code	Particulars
34	NX30433	NX 3 Axis Milling Add-on
35	NX30434	NX NC Simulation Add-on
36	NX30437	NX CAM TeamCentre Client Add-on
37	NX30504	NX Design Simulation
38	NX30507	NX Thermal Simulation
39	NX30508	NX Flow Simulation
40	NX30510	Ansys Environment
41	NX30511	ABAQUS Environment
42	NX30512	NX Motion Simulation-RecurDyn
43	NX30515	NX Advanced Thermal Simulation
44	NX30517	NX Space Systems Thermal Simulation
45	NX30519	NX Electronic Systems Cooling Simulation
46	NX30521	NX Response Simulation
47	NX30522	NX Laminate Composites
48	NX30523	NX LS-Dyna Environment
49	NX30526	NX Motion Control Simulation
50	NX30535	Mechatronics Concept Designer for NX
51	NX30554	NX Topology Optimization
52	NX30620	NX One-Step Formability Analysis
53	NX30624	NX Greater China Toolkit
54	NX31411	CAM Express 3 to 5 Axis Milling Add-on
55	NXN112	NX Nastran Desktop Advanced
56	NXN114	NX Nastran Desktop Rotor Dynamics
57	NXN117	NX Nastran Desktop Optimization
58	NXN120	NX Nastran Desktop Advanced Nonlinear Solver
59	SI2745	NX EPak
60	SI2800	NX Schematics
61	UG10515	Progressive Die Wizard Manufacturing Bundle
62	UG10660	NX Render
63	UG10662NX	Freeform Shape
64	UG10665NX	Visualize Shape
65	UG10670NX	Analyze Shape
66	UG10860	NX Optimization Wizard
67	UG11210	NX Turning
68	UG11216	NX Post Builder
69	UG11219	NX Post Adv Kinematics Library
70	UG11274	Machining Wizard Builder

S. No.	Module Code	Particulars
71	UG11470	NX Fabric Flattener
72	UG12500	NX Advanced FEM
73	NX30531	NX Advanced Durability
74	NX30611	NX Motion Flexible Body
75	NX30155	NX EasyFill Analysis
76	NX30688	NX Molded Part Validation
77	NX30158	NX Routing Piping and Tubing
78	NX30160	NX Routing Harness
79	NX30555	NX Shape Optimization
80	NX30210	NX CMM Inspection Programming Add-on

2. List of Software Modules in Solid Edge Academic Bundle

S. No.	Module Code	Particulars
1	SE289-ENG	Solid Edge Classic - Node Locked
2	SE314-ENG	Solid Edge WebPublisher - Node Locked
3	SE321	Solid Edge Machinery Library - Node Locked
4	SE323	Solid Edge Piping Library - Node Locked
5	SE330-ENG	Solid Edge/Catia V4 Translator Node Locked
6	SE360-ENG	Solid Edge Wire Harness Design Node Locked
7	SE370-ENG	Solid Edge Insight Node Locked

3. List of Software Modules in Team Centre Unified Academic Bundle

S. No.	Module Code	Particulars
1	TC10101	TeamCentre Author
2	TC10405	TeamCentre Open (SDK)
3	TC10408	Multi-Site Collaboration
4	TC10409	STEP AP 203/214 Translator
5	TC20620	Visualization Mockup
6	TC20705	TeamCentre Visualization & Illustration
7	TC20747	Visualization Quality Producer
8	TC30600	NX Embedded Client
9	TC31005	Integration for Mentor Board Station
10	TC31006	Integration for Cadence Allegro
11	TC31007	Integration for ClearCase
12	TC31301	Simulation Author
13	TC31303	RTT Author & Alignment
14	TN85005NU	Process Simulate on TeamCentre Named User
15	TCM055010	TeamCentre Manufacturing Resource Library
16	TC031201	As-Built Management User
17	TC050420	Issue Management and CAPA

4.   List of Software Modules in Tecnomatix Manufacturing Academic Bundle

S. No.	Module Code	Particulars
1	FC10014	FactoryCAD Floating
2	FC11750	In Context Editor (ICE) - AutoCAD/FactoryCAD - Node Locked
3	JK10610	Jack
4	JK10712	Jack Motion Capture Toolkit
5	JK10725	Jack Occupant Packaging Toolkit
6	JK10730	Jack Task Analysis Tool Kit
7	TN11520C	RealNC Float
8	TN11538C	Machine Configurator Advanced Float
9	TN11712C	RealNC Optimization Float
10	TN55005C	Process Designer Concurrent
11	TN55010C	Alternative Planning Concurrent
12	TN70005C	Process Simulate Concurrent
13	TN70015C	Process Simulate Spot Concurrent
14	TN70020C	Robotics Concurrent
15	TN70025C	Commissioning Concurrent
16	TN70030C	Process Simulate Human Concurrent
17	TN70031C	Process Simulate Human Advanced (Jack) Concurrent
18	TN70100C	KUKA KRC OLP Float
19	TN70110C	ABB Rapid OLP Float
20	TN70135C	KAWASAKI AS OLP Float
21	TN75040C	Plant Simulation Education Concurrent
22	TN75080C	Plant Simulation Options Pack for EDU. Licenses Concurrent
23	TN85005C	Process Simulate on TeamCentre Float
24	VS20530	TeamCentre Visualization Mockup
25	VS21306	TeamCentre Visualization Animation Creation Option
26	TN90005	RobotExpert
27	TN90100	KUKA KRC OLP for RobotExpert
28	TN90110	ABB RAPID OLP FOR RobotExpert
29	TN90125	FANUC RJ OLP for RobotExpert
30	TN90130	YASKAWA INFORM OLP for RobotExpert
31	TN90135	KAWASAKI AS OLP for RobotExpert

5. List of Software Modules in Tecnomatix RobCAD Academic Bundle

S. No.	Module Code	Particulars
1	TN60005C	Robcad Concurrent
2	TN60015C	Robcad Spot Concurrent
3	TN60025C	Arc Concurrent
4	TN60030C	Cut and Seal Concurrent
5	TN60035C	Paint Concurrent
6	TN60045C	Cable Simulation Concurrent
7	TN60055C	Rose Development Kit Concurrent
8	TN60065C	ABB Rapid S4 OLP Package Concurrent
9	TN60070C	ABB Rapid S4 Paint OLP Package Concurrent
10	TN60090C	Fanuc RG2 OLP Package Concurrent
11	TN60095C	Fanuc RJ OLP Package Concurrent
12	TN60097C	FANUC F100iA OLP Float
13	TN60110C	Kawasaki 400PC OLP Package Concurrent
14	TN60111C	Kawasaki AD OLP package Concurrent
15	TN60112C	Kawasaki C-CKE OLP Package Concurrent
16	TN60115C	Kobelco OLP Package Concurrent
17	TN60120C	Kuka OLP Package Concurrent
18	TN60125C	Nachi AP OLP Package Concurrent
19	TN60126C	Nachi AR OLP package Concurrent
20	TN60127C	Nachi AW OLP package Concurrent
21	TN60128C	Nachi AX OLP package Concurrent
22	TN60155C	Yaskawa NX OLP Package Concurrent
23	TN60160C	Yaskawa XRC OLP Package Concurrent
24	TN60175C	Robcad Catia V5 Interface Concurrent
25	TN60180C	Robcad Pro Engineer Interface Concurrent
26	TN60185C	Robcad Standard Interfaces Concurrent
27	TN70037C	Process Simulate Continuous Manufacturing Concurrent
28	TN70080C	Catia V5 Interface Concurrent
29	TN70090C	VKRC1/2 (KUKA - VW) OLP Float
30	TN70120C	COMAU PDL OLP Float
31	TN70125C	FANUC RJ OLP Float
32	TN70130C	YASKAWA INFORM OLP Float

6.   List of Software Modules in NX Nastran Academic Bundle

S. No.	Module Code	Particulars
1	NX30600	NX PCB Exchange
2	NXN001	NX Nastran Basic
3	NXN002	NX Nastran Advanced
4	NXN004	NX Nastran Dynamic Response
5	NXN005	NX Nastran Aeroelasticity
6	NXN007	NX Nastran Optimization
7	NXN008	NX Nastran Super Elements
8	NXN009	NX Nastran DMAP
9	NXN010	NX Nastran DMP
10	NXN014	NX Nastran Rotor Dynamics
11	NXN020	NX Nastran Advanced Nonlinear Solver

7.   List of Software Modules in FEMAP Academic Bundle

S. No.	Module Code	Particulars
1	E310	FEMAP Flow Solver (Floating)
2	E503	FEMAP with NX Nastran : Dynamic Response (Floating)
3	E505	FEMAP with NX Nastran : Aeroelasticity (Floating)
4	E509	FEMAP with NX Nastran : Design Optimization (Floating)
5	E510	FEMAP with NX Nastran : Superelements (Node Locked)
6	E511	FEMAP with NX Nastran: Super Elements (Floating)
7	E513	FEMAP with NX Nastran : DMAP (Floating)
8	E515	FEMAP with NX Nastran: Advanced Nonlinear Solver (Floating)
9	E517	FEMAP with NX Nastran: Rotor Dynamics (Floating)
10	E519	FEMAP with NX Nastran: Topology Optimization (Floating)

8.   List of Software Modules in Vistagy Academic Bundle

S. No.	Module Code	Particulars
1	FSNX200	Fibersim for NX Academic Bundle

9. **Siemens Sinumerik CNC Training Racks**

	Training kits	Capabilities
1	Sinumerik 840D SL	• CNC programming simulator kit • Learning of Turning & Mill programming • Hands on CNC service and maintenance training can be undertaken • PLC programming training can also be undertaken • Drive commissioning can also be undertaken.

10. **Training Equipment for Process Instrumentation Lab.**

SIMATIC PCS 7 Training kits & Process Transmitter Racks with Pressure Transmitters, Temperature Transmitter, Level Transmitter (RADAR, Ultrasonic & Capacitive), Flow Transmitters (Electro-magnetic, Coriolis Mass Flow, Ultrasonic) & Electro-pneumatic Valve Positioner.

11. **Specifications for Rapid Prototyping Unit**

Machine Type	Non Laser Based Rapid Prototyping Machine
Technology Application	Process variety of engineering thermoplastics for different applications. Physical parts used for fit, form, visualization, functional testing, jigs & fixtures, patterns for Investment & Sand Casting and final use. Manufacture complex assemblies in single build
Part Manufacturing	Extrusion process depositing uniform layers one above the other. Doesn't involve any toxic, hazardous resin/ solvent/ liquid photo – polymer/ powder based materials
Build Envelope	Minimum 400 x 350 x 400 mm
Layer Thickness	0.2 mm or lesser
Materials Characteristics	a. Process Industrial grade thermoplastics ABS (Acrylonitrile Butadiene Styrene). b. Process high strength thermoplastics material of Aerospace Grade having tensile strength of 70 MPa or more and flexural strength of 100 MPa or more. Raw material should have necessary certification from agencies like FAA. c. Process high heat resistant thermoplastic materials that can withstand more than 180°C. Material chemically resistant to corrosive media like gasoline. d. Process temporary support structures automatically by software during building of part; it should be either water soluble or can be easily removable by hand. e. No expiry date for raw material. Material change easy.
Software	a. Automatic pre-processing, slicing, support generation, part packing/ nesting. b. Create programs for custom & standard sparse builds parts. c. Pause the build to embed inserts during part manufacturing process.
Facility Requirement	a. No special facility required; machine works in office environment. b. Includes all necessary accessories. c. Installation layout diagram provided.
Network Connectivity	TCP/IP 10/100 base T Connection Ethernet Protocol.
Workstation Compatibility	Windows 2000/ XP/7
Operator	Unattended lights out operation. Limited attendance for job start and stop required.
Environmental Requirements	The materials output /waste is eco-friendly and recyclable per Govt. norms.

12. List of Part Components in Advanced Manufacturing Lab

S. No.	Particulars
1	SMATURN CNC Turning Lathe Machine With SIEMENS Industrial Controller
2	CNC Vertical Milling Machine with SIEMENS Industrial Controller
3	Pick and Place Robotic Cell
4	Arc Welding Robotic Cell – MIG Welding
5	Spot Welding Robotic Cell

12 Specifications of SMATURN CNC Lathe Machine

CNC Turning Centre with Industrial Control Panel with closed loop servo motor control with further option of linking to CAD/CAM Manufacturing System.

S.No	Title	Description	Unit	Data
7	LUBRICATION			
7.1		Spindle bearings	type	Grease packed
7.2		Guideways and ball screws	type	Automatic pressure lubrication with low level detection
7.3		Lubrication tank capacity	litres	3
8	COOLANT			
8.1		Coolant tank capacity	litres	60
8.2		Coolant pump motor	kW	0.2
9	POWER SOURCE			
9.1		Electrical power supply - Voltage	V	AC 415 ± 10 %
9.2		- Frequency	hz	50 ± 1
9.3		Electrical power requirement	Kva	15
9.4		Compressed air requirement (at NTP)	lpm	nil
10	MACHINE SIZE (approximate)			
10.1		Machine Front x Side x Height	mm	2275 x 1640 x 1620
10.2		Machine weight, excluding accessories	kg	2000
10.3		Colour - Machine	Shade	Green & Beige
11	ACCURACY (±B)			
11.1		Positioning accuracy - X Axis	mm	0.015
		- Z Axis	mm	0.025
11.2		Repeatability - X /Z Axes	mm	± 0.003
12	STANDARD ITEMS			
12.1		Coolant system, 50 lpm @ 0.88 bar		
12.2		Graphic display		
12.3		Automatic lubrication unit		
12.4		Machine lamp		
12.5		Sliding door interlock		
12.6		Built-in AC (indigenous)		
12.7		Foot switch for chucking		
12.8		Coolant nozzle above headstock		
12.9		Manual Pulse generator		
12.10		Set of turret tool holders	set	1
12.11		Levelling pads	set	1
12.12		Machine manuals	set	1
12.13		Maintenance tools	set	1
12.14		Process completion lamp (3 tier)		
12.15		Absolute encoder		
12.16		Tool life management		

S.No	Title	Description	Unit	Data
1	CAPACITY			
1.1		Swing over bed, dia	mm	480
1.2		Swing over carriage, dia	mm	260
1.3		Admit between centres	mm	345
1.4		Maximum turning length (with chuck)	mm	262"
1.5		Maximum turning diameter	mm	200
1.6		Chuck size, dia	mm	165
2	TRAVERSE			
2.1		Cross travel (X Axis)	mm	105
2.2		Longitudinal travel (Z Axis)	mm	320
3	SPINDLE			
3.1		Spindle nose	type	Flat (dia 140mm)
3.2		Spindle bore taper	type	1 / 20
3.3		Hole through spindle, dia	mm	53
3.4		Max. bar capacity, dia	mm	42"
3.5		Spindle speed	rpm	4500
3.6		Spindle front bearing, ID	mm	80
3.7		Spindle motor power, AC - Cont / 50-60% (SIEMENS)	kw	7/11.5
4	FEED SYSTEM			
4.1		Rapid traverse rate - X & Z Axes	mm / min	20000
4.2		Ball screw - Dia x Pitch - X Axis	mm	25 X 10
		- Z Axis	mm	32 X 10
4.4		Feed motor torque - X & Z Axes (SIEMENS)	Nm	6
4.5		Feed back elements	type	Absolute Encoder
4.6		Guideways	type	Linear Motion Bearing
5	TURRET			
5.1		Actuation	type	Hydraulic
5.2		Turret clamp	type	Hydraulic
5.3		No. of stations	nos	8
5.4		Tool shank size	mm	20 X 20
5.5		Maximum boring bar diameter	mm	32
5.6		Indexing system		Bi directional, Shortest path
6	TAILSTOCK			
6.1		Quill dia	mm	80
6.2		Quill stroke	mm	80
6.3		Quill taper	type	MT-4

13. Tooling Package for SMATURN CNC Lathe Machine

S. No.	Particulars
1	External turning carbide tool holders with inserts
2	Internal boring carbide tool holders with inserts
3	Centre Drill
4	Twist Drill

14. Specifications of CNC Vertical Milling Machine

A 5 Axes CNC Vertical Milling Machine with closed loop servo motor control fitted with Industrial Control Panel with further option of linking with CAD/CAM a Manufacturing System.

Title	Description	Unit	LV 45
Stroke	X Axis	mm	450
	Y Axis	mm	350
	Z Axis	mm	350
	Distance from spindle nose to table top	mm	200 – 550
Table	Table Size	mm	600 x 350
	No. of T Slots x Size x Pitch	Nos. x mm x mm	3 x 14 x 125
	Max. Load on table	kgs	200
Spindle	Spindle bore taper	type	BT – 40
	Spindle speed	rpm	8000
	Spindle Motor power (Cont./15mins.)	kW	3.7 / 5.5
Feed System	Rapid traverse rate – X & Y Axes	m/min	36 & 36
	Rapid traverse rate – Z Axis	m/min	24
	Cutting feed rate	m/min	10
Automatic Tool Changer	ATC		Armless Umberlla
	No. of tools	Nos.	16
	Tool shank	type	BT – 40
	Max. tool diameter with adjacent tool	mm	80
	Max. tool length	mm	160
	Max. tool weight	kg	8
	Tool change time (tool to tool)	sec	6.5
CNC System	Controller	type	Siemens 282D
Machine size	Front x Side	mm	1780 x 2716
	Machine weight (Approx)	kg	2000

15. Specifications of CNC Controller System – Siemens 282 D

S.No	Title	Description	Specification
1	CONTROL		
1.1		Number of controlled axes	Two (X & Z)
1.2		Simultaneously controllable axes	Two
1.3		Incremental input & output	Minimum : 0.001mm
2	FEED FUNCTIONS		
2.1		Rapid traverse rate	X : 20 m / min ; Z : 20 m / min
2.2		Rapid traverse override steps	0 - 120%
2.3		Cutting feed rate override steps	0 - 120%
2.4		Manual jog feed rate	0 to 1200 mm/min in 16 steps
2.5		Manual handle feed	In steps of 0.001, 0.01 & 0.1mm
2.6		Backlash compensation	Compensation of mechanical play separately settable for each axes.
2.7		Stored pitch error compensation	Correction of ball screw pitch error separately settable for each axis
2.8		Dwell	By G04 : 0 to 99999.999 sec
3.0	SPINDLE FUNCTIONS		
3		Spindle speed command	S - 4 digit direct
4	TOOL FUNCTIONS		
4.1		Tool function	Tool commanded by a 2 digits T code Offset commanded by a 2 digits D Code - Ex: T01D01
4.2		Cutter radius compensation	G40 : Tool nose radius compensation - Cancel G41 : Tool nose radius compensation - Left G42 : Tool radius compensation - Right
4.3		Tool offset	Max T/D=8/64

S.No	Title	Description	Specification
5	PROGRAMMING FUNCTIONS		
5.1		Part program storage	1 MB
5.2		No. of programs registerable	100
5.3		Sub program	Subroutines are called in a program(main or subprogram) with their names. To do this , a separate block is required. Call of the subroutine L785 – Ex: L785 (Any name) Call of the subroutine SHAFT 7 - Ex: SHAFT 7 (Any name) If a subroutine is to be executed several times in succession, write the number of times it is to be executed in the block of the call after the subroutine name under the address "P". A maximum of 9999 passes are possible (P1...P9999) Ex.N10 L785 P3; Call of the subroutine L785, 3 passes Subroutines can also be called from a subroutine,not only from a main program.Totally , 8 program levels,including the main program level are available for such a nested call Sub program call by xxxx : Sub program name is xxxx. Nesting depth : 8
5.4		Inch / Metric selection	G70 : Inch input. G71 : Metric input G700: Feed Inch input , G710 Feed Metric input
5.5		Absolute / Incremental selection	X, Z : Absolute input I,K : Incremental input IC/AC: Incremental / Absolute command For Eg: N10 G90 X10 Z=IC(20) Z – Incremental dimension X – Absolute dimension
5.6		Positioning	G00
5.7		Linear interpolation	G01
5.8		Circular interpolation	G02 - Clockwise G03 - Counter clockwise CIP – Circular Interpolation via intermediate point CT – Circular interpolation, tangential transition Capable of interpolation circular arcs extending along all the Four quadrants
5.9		Miscellaneous functions	2 digit M code
5.10		Fixed cycles	Simplified commands for machining operations Cycle 90 Thread milling Cycle 93 Grooving Cycle 93 Grooving cycle Cycle 94 Undercut DIN 76 (forms E and F) finishing Cycle 95 Stock removal with relief cutting Cycle 97 Thread cutting Cycle 81 Drilling & Centering Cycle 82 Drilling & Counterboring Cycle 83 Deep – hole drilling Cycle 84 Rigid tapping cycle Cycle 840 Tapping with compensating chuck cycle Cycle 85 Reaming Cycle 86 Boring Cycle 87 Boring 3 Cycle 88 Boring with stop Cycle 89 Boring 5

16. Specifications for Pick and Place Robotic Cell

	Equipment Specification
1	Robot – KUKA/ ABB/ FANUC
2	Robot Controller – KUKA/ ABB/ FANUC Controller
3	Monitor
4	Release Device
5	Magazine
6	Control Panel
7	Table
8	Safety Fence
9	Voltage Stabilizer with Isolation Transformer
10	Air Compressor

17. Specifications for MIG Welding Robotic Cell

Equipment Specification	
1	Robot – KUKA/ ABB/ FANUC
2	Robot Controller – KUKA/ ABB/ FANUC Controller
3	Welding Machine – Fronius/ Lincoln/ Kemppi/ Miller
4	Robotic Torch
5	Wire Feeder
6	Wire Spool
7	Stationery Work bench
8	Voltage Stabilizer with Isolation Transformer
9	Mixed gas with Cylinder and regulator
10	Torch Cleaning and Wire Cutter Station

18. Specifications for SPOT Welding Robotic Cell

	Equipment Specification
1	Robot – KUKA/ ABB/ FANUC
2	Robot Controller – KUKA/ ABB/ FANUC Controller
3	Spot welding gun and standard accessories
4	Tip Dresser Station
5	Air Compressor
6	Voltage Stabilizer with Isolation Transformer
7	Water circulation system

19. Details of Renewable Energy Lab (Solar/ Wind)

The Basic Renewable Energy Training System provides in-depth coverage of foundational renewable energy systems. It provides an introduction to DC power circuits, and covers in detail the principles behind the production of electrical energy from both solar power and wind power. The students are then introduced to the storage of electrical energy produced from renewable resources into lead-acid batteries for future consumption.

Topic coverage

- DC Power Circuits
- Lead-Acid Batteries
- Solar Power (Photovoltaic)
- Introduction to Wind Power

Main equipment

- Workstation
- Wind Turbine Generator/
- Controller
- Resistive Load
- Lead-Acid Batteries
- Lead-Acid Battery Pack
- Solar Panel Test Bench
- Monocrystalline Silicon Solar Panel
- Four-Quadrant Dynamometer/Power Supply

The DC Power Electronics Training System provides a comprehensive study of the diode and switching transistor, two semiconductor components that are widely used in power electronics circuits. The training system also provides in-depth coverage of various types of choppers, a power electronics device used in many DC power circuits. The operation of these modules is controlled via the LVDAC-EMS software, which also provides the instrumentation required to measure and record the experimental data.

Topic coverage

- DC Power Circuits
- DC Power Electronics

Main equipment

- Workstation
- Resistive Load
- Filtering Inductors/Capacitors
- Lead-Acid Battery Pack
- IGBT Chopper/Inverter
- Four-Quadrant Dynamometer/
- Power Supply
- Data Acquisition and Control Interface

The Hydrogen Fuel Cell Training System realistically demonstrates the basic functions of a 50 W hydrogen fuel cell system and is ideal for teaching the basic engineering principles of fuel cell systems. The modular design of the system enables flexibility in setup complexity – from simple experiments for teaching basic principles to complex experiments for experienced students. The course covers the structure and functioning principles of thermodynamics theory, and characteristics of a real fuel cell system.

Topic coverage

- Basic Functions of the Fuel Cell System
- Characteristic Curve of a Fuel Cell
- Parameters Influencing the Characteristic Curve
- Determination of the Hydrogen Current Curve
- Efficiency of the Fuel Cell Stack
- Set-up of a Fuel Cell Power Supply
- Efficiency of a Fuel Cell Power Supply
- Application I: Remote Traffic Light
- Application II: Fuel Cell Car

Main equipment

- Workstation
- Traffic Lights
- Electronic Load
- Hydrogen Fuel Cell

The Solar/Wind Energy Training System forms a complete hybrid energy training system. This modular program will be designed to cover the history, fundamentals, installation, operation, maintenance, and servicing of alternative energy systems.
The Solar/Wind Energy Training System includes everything required to function as a stand-alone, hands-on learning workstation: Instructor Guide, Student Guide, training modules with fault insertion, and power generating equipment. The training is done with real-world components that are used in industry; the same components that students will see in their own homes, schools, or workplaces.

Topic coverage:

- Energy Fundamentals
- Trainer Familiarization and Safety
- Solar Module
- Wind Turbine
- Solar/Wind Systems
- Going Green

The detailed Bill of Material (BOM) of this Lab. is as below:

S. No.	Description	Quantity
a)	**SOLAR ENERGY TRAINING SYSTEM (CUSTOMISED 8010-5):** **Description** The solar Energy Training System provides in-depth coverage of basic renewable energy systems. It provides an introduction to DC power circuits, and covers in detail the principles behind the production of electrical energy from solar power. Finally, the training system introduces students to the storage of electrical energy produced from renewable resources into lead-acid batteries for future consumption. **Each set consisting of:** • 1x Three-Module Workstation • 1x Lead-Acid Batteries • 1x Solar Panel Test Bench • 1x Monocrystalline Silicon Solar Panel • 2x Digital Multimeter • 1x Pyranometer • 1x Connection Lead Set • 1x Four-Quadrant Dynamometer/Power Supply • 1x Heavy-Duty Tripod • 1x Resistive Load • 1x DC Power Circuits • 1x DC Power Circuits • 1x Lead-Acid Batteries • 1x Lead-Acid Batteries • 1x Solar Power (Student Manual) • 1x Solar Power (Instructor Guide) • 1x Dust Cover for Workstation 8131	1 SET
b)	**WIND ENERGY TRAINING SYSTEM (CUSTOMISED 8010-5):** **Description** The Wind Energy Training System provides in-depth coverage of basic renewable energy systems. It provides an introduction to dc power circuits, and covers in detail the principles behind the production of electrical energy from wind power. Finally, the training system introduces students to the storage of electrical energy produced from renewable resources into lead-acid batteries for future consumption. **Each set consisting of:** • 1x Three-Module Workstation • 1x Wind Turbine Generator/Controller • 1x Resistive Load • 1x Lead-Acid Batteries • 1x Lead-Acid Battery Pack • 1x Timing Belt • 2x Digital Multimeter • 1x Connection Lead Set • 1x Four-Quadrant Dynamometer/Power Supply • 1x DC Power Circuits • 1x DC Power Circuits • 1x Lead-Acid Batteries	1 SET

		• 1x Lead-Acid Batteries • 1x Introduction to Wind Power (Student Manual) • 1x Introduction to Wind Power (Instructor Guide) • 1x Dust Cover for Workstation 8131	
c)	**WIND ENERGY TRAINING SYSTEM (CUSTOMISED 46120-0A):** **Description** The Wind Energy Training System, Model 46120, is the main variant of the program. It forms a complete hybrid-energy training system that teaches students how wind turbines are used in today's consumer and industrial markets. During the course of their training, students learn how to install the system components, operate the system, and measure the different parameters important to the production of energy from wind power. The Wind Energy Training System includes everything required to function as a stand-alone, hands-on learning workstation: wind power-generating equipment, training modules with fault-insertion capabilities, student manuals, and instructor guides. **Each set consisting of:** • 1x Mobile Workstation • 1x Battery Bank • 1x Battery Bank Junction Box • 4x Electrical AC Outlet • 3x Ammeter • 1x DC Power Distribution Panel • 1x Horizontal-Mount Disconnect Switch • 1x Vertical-Mount Disconnect Switch • 1x Diversion Load Controller • 1x Dump Load • 3x DC Circuit Breaker • 1x kWh Meters with AC Circuit Breaker Box • 4x AC/DC Wall Switch • 1x Lockout/Tagout Module • 1x Power Bus Bar • 1x Power Usage Monitor • 1x Power Inverter with Remote Control • 1x Stop Switch • 3x DC Lamp Socket • 1x Wind Turbine Generator with DC Motor (for Wind Simulator) • 1x DC Motor Controller (for Wind Simulator) • 1x Accessories Package • 1x Connection Cables Kit • 1x Multimeter • 1x Wind Power Textbook (author, Paul Gipe) • 1x Wind Turbine (Student) • 1x Wind Turbine (Instructor)	1 SET
d)	**HOME ENERGY (SOLAR/WIND) TRAINING SYSTEM (46120-0A):** **Description** The Solar/Wind Energy Training System, Model 46120, is the main variant of the program. It forms a complete hybrid-energy training system that teaches students how solar panels and wind turbines are used in today's consumer and industrial markets. During the course of their training, students learn how to install the system components, operate the system, and measure the different parameters important to the production of energy from solar power and wind power.	1 SET

The Solar/Wind Energy Training System includes everything required to function as a stand-alone, hands-on learning workstation: solar and wind energy power-generating equipment, training modules with fault-insertion capabilities, student manuals and instructor guides.

Each set consisting of:
- 1x Solar/Wind Energy Mobile Workstation
- 1x Battery Bank
- 1x Battery Bank Junction Box
- 4x Electrical AC Outlet
- 3x Ammeter
- 1x DC Power Distribution Panel
- 2x Horizontal-Mount Disconnect Switch
- 2x Vertical-Mount Disconnect Switch
- 1x Diversion Load Controller
- 1x Dump Load
- 3x DC Circuit Breaker
- 1x kWh Meters with AC Circuit Breaker Box
- 4x AC/DC Wall Switch
- 1x Lockout/Tagout Module
- 1x Power Bus Bar
- 1x Power Usage Monitor
- 1x Power Inverter with Remote Control
- 1x Solar Charge Controller
- 1x Stop Switch
- 3x DC Lamp Socket
- 1x Photovoltaic (PV) Module Assembly
- 1x Wind Turbine Generator with DC Motor (for Wind Simulator)
- 1x Solar Array Junction Box
- 1x Sun Simulator Assembly
- 1x DC Motor Controller (for Wind Simulator)
- 1x Accessories Package
- 1x Connection Cables Kit
- 1x Multimeter
- 1x Photovoltaic Systems Textbook (author, James P. Dunlop)
- 1x Wind Power Textbook (author, Paul Gipe)
- 1x Solar Module (Student)
- 1x Solar Module(Instructor)
- 1x Wind Turbine (Student)
- 1x Wind Turbine (Instructor)
- 1x Solar/Wind Systems (Student)
- 1x Solar/Wind Systems (Instructor)
- 1x Energy Fundamentals (Job Sheets - Student)
- 1x Energy Fundamentals (Job Sheets - Instructor)
- 1x Trainer Familiarization and Safety (Job Sheets - Student)
- 1x Trainer Familiarization and Safety (Job Sheets - Instructor)
- 1x Going Green (Job Sheets - Student)
- 1x Going Green (Job Sheets - Instructor)

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20. Details of Metrology Lab

The Metrology lab consists of the following equipments:

a) Coordinate Measuring Machine (CMM)
b) Quality Assurance Tools and Gages

a) Coordinate Measuring Machine (CMM) Details

The CMM machine which is being provided for this lab is the CARL Zeiss 3D CNC Co-ordinate Measuring Machine. Model: DuraMax 5/5/5 LTE (Quantity 1 No.)

The technical details of the machine are:

Measuring Range: X=500 mm, Y=500 mm, Z=500 mm
Measuring uncertainty in accordance with ISO 10360-2:2001
$MPE\_E = 2.9 + L/300$ μm (at 18°C – 22°C)
Probing tolerance complies with ISO 10360-2:2001
$MPE\_P = 2.4$ μm
Scanning tolerance complies with ISO 10360-4:2001 $MPE\_THP = 3.8$ μm in 68 s

Accessories:
- Numerical control panel
- 25mm diameter reference sphere
- 70 cm height, resulting in 91 cm measurable table height
- AC power Cord, IEC,120V

Probe System:
- VAST XXT TL3 – Passive scanning probe w/accessories and tools
- Basic probe kit

Software:
- CALYPSO Software – Dongle Base License

Services:
- CMM Operator Manual, Acceptance Documents
- Shipping Skid, Packaging and Bracing
- Small Accessories Crate

b) Quality Assurance Tools & Gages

The various quality assurance tools and gages are as mentioned below:

Vernier Caliper - Digital				
Sl. No	Reading	Range	Features	Quantity
1	0.02mm	0 – 150 mm	- With 0.02mm Least count - To check ID, OD, Step & Depth - Accuracy as per DIN 862	2
Digital Caliper				
Sl. No	Reading	Range	Features	Quantity
2	0.01mm	0 – 200 mm	- with 0.01mm Least count - To check ID, OD, Step & Depth - Accuracy as per DIN 862	1
Micrometer				
3	0 – 25mm	0.01mm	- Stainless Steel spindle for rust prevention.	1
4	25 – 50mm	0.01mm		1
5	50 – 75mm	0.01mm	- Robust design withstands toughest workshop conditions. - Sharp laser markings for better visibility & durability.	1
Digital Micrometer				
6	0 – 25mm	0.001mm	- Accuracy confirming to DIN 863/1.	1
7	25 – 50mm	0.001mm	- Stainless steel spindle to avoid rust. - Carbide measuring faces. - mm/ Inch conversion. - Auto power-off. - Absolute & Incremental measuring mode. Incremental mode allows the zero to be set at any point for making comparative measurements.	1
Digital Height gauge				
8	3000 mm	0.01mm	- Robustly constructed, Stainless Steel column with clearly marked scale graduation. - A clear Multifunction Digital LCD display runs smoothly on the Analog vertical scale. - Carbide tipped scriber. - Functions consist of Power ON/OFF, bsolute/Incremental mode, mm/in., Preset, Hold, and Tolerance setting.	1

Bevel Protractor				
9	2 x 180 Deg			1
10	4 x 90 Deg			1

Dial Gauges				
11	0.01 mm	25 mm	Plunger Type	1
12	0.01 mm	10 mm	Plunger Type	1

Surface plate				
13	"0"	1000 x 1000	Less than or equal to 4.0 m	1

Profile Projector			
14	Type	Horizontal - DRO with 1 micron scale	1
	Screen Size	Minimum 350mm	
	Cross table size	400 X 200mm minimum	
	Measuring range	200mm X 150mm minimum	
	Magnifications	10X, 20X, 25X,50X,100X	
	Magnifications Accuracy	± 0.05% Contour ± 0.10% Surface	
	Lens System	Telecentric Lens system	
	Profile illumination	150 Watts	

Toolmaker Microscope			
	XY Measuring range	100mm X 50mm (minimum)	
	Objectives	2X , working distance: 67mm	
	Eye piece	15X	
15	Total Magnification	30X	1