

**Maulaana Azad National Institute of Technology Bhopal  
(M.P.)**

**Department of Mechanical Engineering**

Details of Laboratory Facilities:

**Dynamics of Machines Laboratory**

**Laboratory In charge: Dr R. S. Rana**

S. No.	Name of Equipment/ Instruments	Specifications	Specific Utility
1.	Various portable models of kinematic chain and power transmission system	----	Demonstration of various aspects of kinematics and dynamics of machines
2.	Universal vibration apparatus	Spring, pendulum, shaft , motor and frame attachment	Demonstration of longitudinal ,transverse vibration and torsional vibration
3.	Polishing machine	Motor, rotating disc with attachment.	Polishing of specimens for microstructural characterization
4.	Whirling of shaft Apparatus	Frame, motor, shafts of various diameters, bearings.	Demonstration of whirling phenomenon
5.	Cam analysis Apparatus	Cam and follower attachment with motor different type of cams and followers	Demonstration of jump phenomenon of cam and follower
6.	Balance	Automatic balance machine	To measure the material weight.
7.	Ultrasonic digital sonicator and Air compressor	Sonicator 1200 watt power and 20.20 KHz frequency Support stand Air compressor	Sonication in liquid metals for uniform distribution of particles
8.	Controlled atmosphere Melting furnace with stir & Ultrasonic arrangement.	Heating coil 1000°C, chiller unit, Argon cylinder with regulator.	Melting and casting of Aluminum alloys and Nano composites.
9.	Fatigue testing Machine	Machine with frame, digital counter, set of weights and tool kit	Rotating bending fatigue testing of the specimen
10.	Single Disc Polishing Machine	Motor, rotating disc with attachment.	Polishing of specimens
11.	Computerized Pin on disc wear testing Machine	Ducom-TR-20LE Pin-on Disc Wear Testing Machine.	Testing of dry sliding and lubricating wear of the material

## Advance Machine Tool Lab.

**Laboratory In charge: Dr. R. K. Dwivedi**

S. No.	Machine Name	Specification	Utility
1	3D Printer (J Group Robotics)	Build Volume Bed Size / Print size (X Y Z) - 250mm x 250mm x 300mm Machine Dimensions - 650mm x 480mm x 850mm Machine Accuracy XY positioning accuracy - within 10 microns Z positioning accuracy - within 10 microns Repeatability accuracy – within 10 microns Auto Bed level height map – within 50 microns	For Research purpose, Making 3D models, Demonstrations of 3D Printing
2	3D Printer, ProtoCentre 999 (Aha! 3D)	Build Volume Featuring a large 9 x 9 x 9 cubic inches (230 x 230 x 230 cubic mm) build volume, the 3D printer gives you a great working area for realizing your creations Dual Extruders The ProtoCentre 999 features dual all-metal e3d extruders, which are well-known for their reliability, precision and performance. You can use the two extruders for main, support, or dual colour prints	For Research purpose, Making 3D models, Demonstrations of 3D Printing
3	CNC milling machine emco concept Turn 55	Work area Travel in X/Y/Z: 190/140/260 mm Distance spindle nose: 77 - 337 mm Number of axes: 3 (4th axis optionally) Rapid motion speeds in X/Y/Z: 2 m/min Work feed X/Y/Z: 0-2 m/min Feed force in X/Y/Z: 800/800/1000 N	1.Contour milling 2.Thread milling 3.Tapping 4.Drilling
4	CNC Lathe machine emco concept Turn 55	WORK AREA Travel in X/Y/Z: 48/-/236 mm Max. turning diameter: 52 mm Max. part length with tailstock: 215 mm Swing over bed: 130 mm Tool cross-section for outer machining: 12 x 12 mm Tool cross-section for inner machining: Ø 10 Rapid motion speeds in X/Y/Z: 2 m/min Work feed X/Y/Z: 0 - 2 m/min Feed force in X/Y/Z: 1000 N Main spindle Max. speed: 120 - 4000 rpm Max. drive power: 0.75 kW	1.Turning small parts made of aluminium, brass and plastics 2.Facing 2.Lon2.longit udinal turning 3.Contour turning 4.Thread cutting 5.Drilling 6.Tapping
5	Rapid Prototyping Dimension SST	<ul style="list-style-type: none"> <li>• Competitive with other RP technologies</li> <li>• Strong and durable model</li> <li>• APS plastic (with color choices) and</li> </ul>	FDM uses production-grade thermoplastics, such as ABS, ABSi,

	768 FDM	<p>Elastomer material choices</p> <ul style="list-style-type: none"> <li>• Water proof, paintable</li> <li>• Maximum size- 10" x 10" x 16"</li> <li>• Maximum dimensions for instant quotes: 20"x20"x20". Parts with larger dimensions are also available. Maximum dimensions for parts in single build: ABS - 23"x19"x23", Polycarbonate (PC) - 14"x16"x16".</li> </ul>	<p>polyphenylsulfone (PPSF), polycarbonate (PC) and Ultem 9085, including PC-ABS. Because of the material properties, FDM parts typically withstand functional testing and have high heat resistance. Some companies have sterilized PPSF for medical applications, however material manufacturer Stratasys does not advertise that PPSF is sterilizable</p>
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### Nano Composite Laboratory

**Laboratory In charge: Dr. Rajesh Purohit**

S. No.	Name of Equipments	Specifications	Utility
1.	Computerized Universal Testing Machine (100 Ton Capacity)	<p>Capacity: 1000 KN (100 Ton)            Make: Fine            Stroke/ Travel: 1200 mm            Straining Speed: 50-120 mm/minute            Piston stroke: 200-300 mm            Resolution Piston movement: 0.1 - 0.2 mm            Least Count for Force measurement: 0.3 % of max. Load            Provision to operate UTM in different ranges like 0-100 KN, 0-250 KN, 0-500 KN 0-1000 KN etc.)            (Analog + Computerized)</p>	<p>a. To perform Tensile Test on different materials.            b. To perform Compression Test on different materials.            c. To perform Shear Test on different materials.            d. To perform bend Test on flat specimen of different materials.            e. Compaction of Metal and Composite Powders at room or high temperature.</p>
2.	Programmable controlled atmosphere Sintering Furnace	<p>Maximum temperature: 1500 °C            Dimension of Heat Zone: Diameter = 100 mm, Length = 180 mm            Length of Furnace = 500 mm            Arrangement to remove the air by vacuum pump and purge the inert gas (Argon).            Provision to run the furnace at vacuum, without purging inert gas, with vacuum pump continuously 'on' while heating.            Cooling arrangement for gas or air before entering the vacuum pump.            Vacuum pump capacity: 10<sup>-3</sup> torr</p>	<p>Used for sintering of different samples at varying temperatures and study the effect of different parameters on properties of composite samples.</p>
3.	Horizontal Ball Mill	<p>Make: Metrex Scientific Instruments, New Delhi            Diameter: 320 mm (Approx.)            Width: 120 mm (Approx.)</p>	<p>To study the effect of ball milling time and ball to powder weight ratio on the</p>

		Speed: 100 rpm (Approx.) (With speed regulator) <b>Provision for filling Argon gas for inert atmosphere through non return valves in the ball mill.</b> Material of the ball mill: Stainless steel Material of Balls: Stainless steel.	Microstructure of different powder mixtures for development of Composite materials.
4.	Programmable Heat treatment Furnace	MAKE: METREX ISO 9001: 2008 CERTIFIED CO. Maximum Temperature 950° C Working Temperature 900° C Inner Muffle Size W x H x D 150 x 150 x 300 mm <sup>3</sup> (6" x 6" x 12")	To study the effect of Heat Treatment temperature and time on properties of high carbon steel samples.
5.	Digital Rockwell cum Brinell Hardness Testing Machine	Make : Fine Test loads (Kgf): 60, 100, 150 (Rockwell), 187.5, 250 (Brinell) Initial Loads (Kgf): 10 Max. Test Height (mm): 300 (Approx.) Make: Fine	To determine the Rockwell & Brinell hardness of the samples of different materials.
6.	Manual Superficial Hardness Testing Machine	Model: SE TWIN Make: Samarth Rockwell Hardness Tester (Combined Model) Suitable for Rockwell & superficial Hardness Measurements. Test loads (Kgf): 60,100, 150 (Rockwell); 15, 30, 45 (Rockwell Superficial) Initial Loads (Kgf): 3 (Rockwell Superficial) & 10 (Rockwell) Max. Test Height (mm): 295, Depth of Throat (mm) 150 Max. Depth of elevating screw below base: 310 mm	To determine the Superficial hardness of the thin samples of different materials.
9.	Automatic Extrusion Line for Tape, Tube, Rod and Wire of different sizes	Make: Sai Extrumech, Faridabad Processing material : Should be suitable for most of the Thermoplastic Materials like PE, PVC, PU etc. Type of construction : Horizontal Centre height : about 1000 mm Max. Temperature : 300 °C or More <b>25 mm Extruder with A/C Motor</b> ➤ L/D Ratio About 25:1 ➤ Cooling in Feeding Zone Through Water ➤ Cooling in Barrel Zone Through Air Heating of Barrel: Through Ceramic Heaters of about 2 KW power With Tape, Tube and wire heads and roller calendaring & Compounding unit.	Used for extruding wires of circular, square and tubular crosses sections.
11.	Digital Magnetic Stirrer with Hot Plate	Model: MS-H280-Pro, Make: SCIOGEX, LED Digital Hot Plate magnetic stirrer LED Digital hot plate magnetic stirrer, Ceramic/Stainless steel hot plate, Speed Range: 100-1500 RPM, Temp. up to 280 °C, LED Display of speed & Temp., Stirring capacity: 3 Litres	Used for mixing of nano/micron particles in liquid medium (Polymers).
12.	Compression Moulding Machine	Make: Kaiser Technicals, Ahmedabad Operation through Hydraulic Power pack system with Pressure regulating System with mechanical needle gauge range up to 250 kg/cm <sup>2</sup> Capacity: 0-30 Tons	Used for development of Polymers and Polymer composite samples and components.

		Platen size: 350 mm X 350 mm Working platen size: 300 mm X 300 mm Specimen thickness tolerance 0.05 mm Stroke: Day Light opening 200 mm Temperature Controller: Max. Working range ambient to 280.0°C and cooling timer max. range 999 minutes.	
13.	Ultrasonic Bath (Clener)	Model: MUB 33 Make: Telesonic Ultrasonics Frequency: 40 KHz Power: 300 W Temperature: 0-80 °C Timer: 1-99 Minutes	Used for mixing of nanoparticles in liquid medium and cleaning of samples.

## Stress and Vibration Analysis Laboratory

**Laboratory In charge: Dr. N. D. Mittal**

S. No.	Name of Equipment/ Instrument	Specifications	Specific Utility
1.	Smart Office (SO) Analyzer	<ul style="list-style-type: none"> <li>• 4-channel vibration analyzer</li> <li>• Thrust shaker</li> <li>• Impact hammer</li> </ul>	The is SO analyzer is a portable instrument which requires power input and is utilized for performing FFT modal and spectrum vibration analysis.
2.	Machinery Fault Simulator-Rotor Dynamics Simulator (MFS-RDS)	<ul style="list-style-type: none"> <li>• 3 phase, 1/2 HP variable frequency drive motor with 0 to 6000 rpm range.</li> <li>• 1/2", 3/4", 1" diameter shaft installation kits with roller and journal bearings.</li> </ul>	The MFS-RDS set up is used for understanding the different faults occurring in the rotating machinery the understanding of which can be utilized to monitor and diagnose the machinery faults before they lead to any damage or catastrophic breakdown.
3.	Vibration Fundamental Training System (VFT)	<ul style="list-style-type: none"> <li>• Linear 1 DOF,2 DOF vibration</li> <li>• Torsional vibration</li> <li>• Beam vibration</li> <li>• Harmonic vibration</li> </ul>	The VFT is used for hands on learning of simple vibration phenomena.
4.	Diffused Light Research Polariscope (Photo Elastic Bench)	<ul style="list-style-type: none"> <li>• Field size - 280 mm diameter</li> <li>• Linear polarized polariscope and quarter wave plates with manual rotation</li> <li>• Hydraulic loading</li> </ul>	Diffused Light Research Polariscope is used for studying the stress distribution patterns spread across the cross section of the specimen under various loading conditions like tension, compression and bending.

## Equipment Health Monitoring Laboratory

**Laboratory In charge: Dr. P. K. Soni**

<b>S. No.</b>	<b>Name of Equipment/ Instruments</b>	<b>Specifications</b>	<b>Specific Utility</b>
1	Machinery Diagnostic system consisting of following units a) Base unit b) Vibration analyser (software) c) Roller Bearing Faults Kit d) Couplings Kit e) Belt Drive Kit f) Damage to Gears kit g) Brake & Load Unit	[1] Computerised vibration analyser for representation and evaluation of experiments with the PT 500 "Machinery diagnosis" series [2] 2 acceleration sensors to record vibration displacement, vibration velocity and acceleration [3] Optical sensor to record rotation speed [4] 2-channel measurement amplifier with adjustable gain [5] Analysis software programmed in LabVIEW [6] Software features: 2-channel oscilloscope; 2-channel FFT analyser; envelope analysis; run-up curve and order analysis; 2-plane field balancing [7] Two displacement sensors PT 500.41 can be connected [8] Suitable for general vibration measurement tasks	-Familiarisation with vibration signals -Correct application of FFT analysis - Measurement of rotation speed, vibration displacement, vibration velocity and acceleration - Assessment of the vibration state of a machine - Damage analysis of roller bearings and gears by means of envelope spectra
2	Clamp on ultrasonic flow meter (Portable) RR flow meter /Model F132	Non Intrusive type / water medium / pipe line size: 750mm NB, 763.64mm OD Flow:200-2000 m <sup>3</sup> /hr	Water flow rate measurement (On line)
3	Clamp on power meter Make Yokogawa / Model CW240	100-240VAC, 50/60 Hz, 1.5/3.75amp; AC adapter 12VDC	Electrical power measurement/analysis
4	Vibration meter (Portable) Lutron, VB-8200	Measurement: Velocity, Acceleration, RMS value Range: Freq. 10Hz-1kHz Velocity range: 200mm/s Acceleration range: 200m/s <sup>2</sup>	On line vibration amplitude measurement

## Heat and Mass Transfer and CFD Laboratory:

**Laboratory In charge: Dr. Rajesh Gupta**

<b>S. No.</b>	<b>Name of Equipment</b>	<b>Specifications</b>	<b>Specific Utility</b>
1.	Thrust measuring stand for pulse jet engine		Thrust measurement
2.	Heat transfer from a pin fin		Heat transfer measurement UG/PG experiment
3.	Thermal conductivity of metal rod		
4.	Emissivity measurement apparatus		Emissivity measurement
5.	Centrifugal blower test ring		To study the effect of forward curved, backward and radial vanes
6.	Unsteady state heat transfer unit		Heat transfer measurement UG/PG experiment
7.	Heat transfer through lagged pipe		Heat transfer measurement UG/PG experiment
8.	Software for IC engine 3D CFD simulation		IC engine simulation for UG/PG/PhD Projects
9.	Thermograph model - T-420 make FLIR	Thermal Imaging Camera, 76800 Pixels (320 x 240)	Thermal Imaging
10.	Gas analyzer exhaust v/s 9046-AVL-250 IN		Measurement of Composition of exhaust gas
11.	Computerized multi fuel variable compression ratio engine		Experiments of engine performance for different flues and compression ratio
12.	Centrifugal blowers & accessories		provide a steady volume of air to create pressure or vacuum
13.	Jet engine component (rejected)		Demonstration model
14.	Hydraulic infinitely variable speed gear		Speed reduction
15.	Sisson lagging apparatus		Experimental Setup
16.	Hot wire anemometer		measure instantaneous fluid velocity
17.	Digital conductivity meter		Conductivity measurement
18.	Apparatus for heat transfer in natural convection		Heat transfer measurement UG/PG experiment
19.	Drop wise & film wise condensation apparatus		Heat transfer measurement UG/PG experiment
20.	Heat transfer in forced convection		Heat transfer measurement UG/PG experiment
21.	Microprocessor based digital thermal conductivity meter		

## Advanced Heat Transfer

**Laboratory In Charge: Dr K R Aharwal**

S. No.	Name of Equipment/ Instruments	Specifications	Specific Utility
01	Camera- TOSHIBA IK-TF9C 3 CCD digital with full PCI express Camera link frame grabber Liquid crystal sheet Data Logger Voltmeter, Ammeter Blower, 3-way valve, Work station, Air heater	Output Resolution of 2048x1536 and 20 frames per second. LCTmade by Hall-crest, Range of (30 <sup>0</sup> C-35 <sup>0</sup> C ), (35 <sup>0</sup> C-45 <sup>0</sup> C ). Agilent LXI data Acquisition unit with 64 channels. 0-600V and 0-20A, Blower-1500 rpm & 0.23 kg/s	This facility is used to measure the temperature filed of heat transferring surface and also to measure the local convective heat transfer coefficient.

## I.C Engine Laboratory

**Laboratory In charge: Dr. Atul Lanjewar**

S. No	Name of Equipment/ Instruments	Specification	Utility
1	Newage Petrol Engine	4-Cylinder, 4-Stroke Petrol Engine 2 OHV per cylinder. Bore diameter – 73 mm, Stroke length – 88, Compression ratio – 7.2, Speed(variable) – 2750 rpm(max)	UG Lab Experiments
2	Gas Turbine with Instrumentation	Single stage centrifugal compression Power : 60 BHP, Pressure ratio : 2.8:1, Speed of turbine shaft : 4600 rpm	PG Lab Research
3	Two Stage Air Compressor with DC Generator Set	1 <sup>st</sup> stage: 2 cylinder, Bore- 101.6mm, Stroke- 101.6 mm Delivery pressure- 10 kgf/cm <sup>2</sup> , 2 <sup>nd</sup> stage: 1 cylinder, Bore- 76.2 mm, Stroke- 101.6mm, Pressure – 13.8 kgf/cm <sup>2</sup> , Max free air delivered – 700 L/min	UG Lab
4	Two Wheeler Chassis Dynamometer	Fitted with Hydraulic dynamometer And SAJ-FROUDE Volumetric Fuel Meter Type SFV-100	UG Lab
5	Four Wheeler Chassis Dynamometer	Fabricated set-up	Research
6	Smoke Meter	Model 437	Research
7	Computerised Engine Scanner for Kirlosker Engine	Engine Specs: Single Cylinder 4 Stroke Diesel Engine	UG/PG Lab Research



	Kirloskar Make Engine with Data Acquisition System, Piezo Electric Pressure Transducer and Controller for fixed speed engine	No of cylinder- 1, No of strokes- 4 Rated power- 5.2 kW@1500 rpm, sfc – 251 g/kWh	
8	Computerised Engine Scanner for Maruti Engine	Engine Specs: 3 Cylinder Petrol Engine No of cylinder- 3, No of strokes- 4 Rated power- 27.6 kW @ 5000 rpm	UG/PG Lab Research
9	2-Stroke Engine set-up with drive coupling, pump assembly, fuel injector and Alternator	Power: 5 kW Alternator: 7 kVA	Research

### Solar Energy Laboratory

**Laboratory Incharge: Dr. Atul Lanjewar**

S. No	Name of Equipment/ Instruments	Specification	Utility
1	Air Flow Meter	Air velocity Range/Accuracy: 1 to 80 m/s/2.5% reading at 10 m/s Air flow (volume) Range/Resolution: 0 to 99,999 cfm/1 cfm	PG Lab Research
2	Universal Recording System For Temperature and Humidity Monitoring	Sampling Rate: $\leq 25$ Hz Operating Temperature range: $-30^{\circ}\text{C}$ to $70^{\circ}\text{C}$ . Humidity: 85% RH, non-condensing	PG Lab Research
3	Pyranometer with Data Logger	Sensitivity : 5 to $20\mu\text{V/W/m}^2$ Detector type : Thermopile Operational temperature range : $-40^{\circ}$ to $+80^{\circ}\text{C}$ Storage temperature range : $-40^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ Humidity range : 0 to 100% non-condensing	PG Lab Research
4	Solar Thermal Training System	Flat Plate Collector: Collector Box Length: 915 mm, Collector Box Breadth: 810 mm Halogen Fixture with regulator having Power rating of 3200 (W)	PG Lab
6	Blower	Centrifugal Blower; Motor 3.7 kW	PG Lab Research
8	Solar Water Heating System	Evacuated tube Collector Tube Length: 1.5 m	UG/PG Research
9	Variac; Digital Voltmeter Digital Ammeter	1 Ph, 240V AC, 15 AMP; Single Phase, 0-750 V AC; Single Phase, 0-20A AC	PG Lab Research
10	Heater	1000 mm length Maximum Flux: $1200 \text{ W/m}^2$	PG Lab Research

## Refrigeration and Air conditioning Laboratory

**Laboratory Incharge: Dr. Manoj Arya**

S. No.	Name of Equipment	Specifications	Specific Utility
01.	ICE PLANT	<ul style="list-style-type: none"> <li>▪ Compressor : Hermetically sealed compressor.</li> <li>▪ Condenser : Air Cooled condenser made out of copper pipe &amp; Aluminum fins of matching capacity with fan cooling.</li> <li>▪ Brine Tank: Brine Tank made out of stainless steel sheets (SS304), insulated(glass wool) from all sides with provision to hold cans, evaporator coil at one side &amp; an arrangement to drain the brine solution. A door is provided at the top of this tank.</li> <li>▪ Expansion device: Thermostatic expansion valve</li> <li>▪ Energy Meter: For power measurement of compressor.</li> <li>▪ Pressure Gauge: 2 Nos. for H.P., L.P. measurement</li> <li>▪ Suitable filter/drier (Molecular sieve type)</li> <li>▪ Hand Shut Off type Service valve.</li> <li>▪ Set of thermocouples.</li> <li>▪ Control panel: Digital Voltmeter: 0-300 Volt.</li> <li>▪ Digital Ammeter:</li> <li>▪ Energy Meter: For power measurement of compressor.</li> <li>▪ Digital Temperature Indicator: 0-300°C (With multichannel switch)</li> <li>▪ On/Off switch, Mains Indicator etc</li> </ul> <p>The whole set-up is well designed and arranged on a good quality painted structure and should contain all necessary accessories for smooth operation of the unit.</p>	For B.Tech 4 <sup>th</sup> year Lab
02.	COMPUTERISED REFRIGERATION CYCLE TEST RIG	<ul style="list-style-type: none"> <li>▪ Refrigeration system : Cooling capacity (450 watt at rated test condition (1/8 TR)</li> <li>▪ Compressor : 1/3 HP, Hermetically sealed, Standard make</li> <li>▪ Condenser : Forced convection Air cooled</li> <li>▪ Condenser fan : Axial flow type (Standard make)</li> <li>▪ Expansion Device : Capillary Tube</li> <li>▪ Evaporator : shell and coil type(Jacketed type with 60 ltrs capacity)</li> <li>▪ Refrigerant : 134a</li> <li>▪ Pressure Indication: 2 No.s pressure transmitters connected to computer through data acquisition system. One fitted at suction side and another at discharge side</li> <li>▪ Voltage Indication : Voltage transmitter connected to computer through data acquisition system</li> <li>▪ Amps Indication : Current transmitter connected to</li> </ul>	For B.Tech 4 <sup>th</sup> year Lab

		<p>computer through data acquisition system.</p> <ul style="list-style-type: none"> <li>▪ Temperature Sensors : RTD PT-100 type connected to computer through data acquisition system.</li> <li>▪ Control Panel : 16 channel data logger for temperature, pressure, voltage &amp; current.</li> <li>▪ The whole set-up is well designed and arranged on a good quality painted structure.</li> <li>▪ Comes with data recording software with tabular view, data graphing &amp; excel sheet printing.</li> <li>▪ Should be supplied with dedicated data recording unit with TFT display and multifunction colour printer with suitable software</li> <li>▪ Should contain all necessary accessories for smooth operation of the unit.</li> </ul>	
03.	COMPUTERISED AIR CONDITIONING CYCLE TEST RIG	<ul style="list-style-type: none"> <li>▪ Compressor: Hermetically sealed compressor.</li> <li>▪ Condenser: Air Cooled condenser made out of copper pipe &amp; Aluminum fins of matching capacity with fan cooling.</li> <li>▪ Evaporator: Air calorimeter type evaporator. The air passed by a fan through duct. The expanded refrigerant passes through evaporator coils, fixed in the duct. The passing air comes in contact with the coils &amp; gets cooled.</li> <li>▪ Expansion device: Thermostatic expansion valve.</li> <li>▪ Energy Meter: For power measurement of compressor.</li> <li>▪ Pressure Gauge: 2 Nos. for H.P., L.P. measurement</li> <li>▪ Hand Shut Off type Service valve.</li> <li>▪ Electric Heater: Finned type heater for air heating.</li> <li>▪ Rotameter for Refrigerant flow measurement.</li> <li>▪ Duct: Air duct of size 250 x 250 make out of CRC sheet in which evaporator is fitted.</li> <li>▪ Baby Boiler: Electrically fired small baby boiler for maintaining humidity of air with electrical heater</li> <li>▪ Blower: 1 HP capacity centrifugal blower with air control arrangement.</li> <li>▪ Control Panel: 16 channel data logger for temperature, pressure, voltage &amp; current.</li> <li>▪ The whole set-up is well designed and arranged on a good quality painted structure.</li> <li>▪ Should be supplied with dedicated data recording unit with TFT display with data recording software with tabular view, data graphing &amp; excel sheet printing software.</li> <li>▪ Should contain all necessary accessories for smooth operation of the unit.</li> </ul>	For B.Tech 4 <sup>th</sup> year Lab
04.	AUTOMOBILE AIR CONDITIONING CYCLE TEST RIG	<ul style="list-style-type: none"> <li>▪ Compressor: Compressor with external motor.</li> <li>▪ Condenser: Air Cooled condenser made out of copper pipe &amp; Aluminum fins of matching capacity with fan cooling.</li> <li>▪ Evaporator: Copper Coil evaporator with blower. Air is forced flow over the evaporator with the help of</li> </ul>	For B.Tech 4 <sup>th</sup> year Lab

		<p>blower cooled before distributor.</p> <ul style="list-style-type: none"> <li>▪ Expansion device: Constant pressure expansion valve.</li> <li>▪ Energy Meter: For power measurement of compressor.</li> <li>▪ Pressure Gauge: 2 Nos. for H.P., L.P. measurement</li> <li>▪ Suitable filter/drier.</li> <li>▪ Hand Shut Off type Service valve.</li> <li>▪ Control chamber with ducting.</li> <li>▪ Rotameter for Refrigerant flow measurement.</li> <li>▪ Electric heaters.</li> <li>▪ Pilot pressure operated throttling valve.</li> <li>▪ Set of thermocouples.</li> <li>▪ Control panel: Digital Voltmeter: 0-300 Volt.</li> <li>▪ Digital Ammeter: 0-2 Amp.</li> <li>▪ Digital Temperature Indicator: 0-300°C (With multichannel switch)</li> <li>▪ On/Off switch, Mains Indicator etc</li> </ul>	
05.	EVAPORATIVE COOLER	<ul style="list-style-type: none"> <li>▪ Duct: 500 x 500 x 800 mm Duct in which evaporative coil is fitted.</li> <li>▪ Evaporative Coil: Hot water is passed through evaporative Coil made of copper.</li> <li>▪ Air Fan with Motor: This suction type air fan is fitted on the top of the duct.</li> <li>▪ Hot water cir. pump: 1/2 HP. 230 V AC hot water circulating pump is used to circulate hot water into the evaporative coil.</li> <li>▪ Cold water Cir. pump: 1/2 HP. 230 V AC cold water circulating Pump is used to circulate cold water which spray on the evaporative coil.</li> <li>▪ Heating Arrangement:Evaporative cooler provided along with geysers.</li> <li>▪ Rotameters: for flow measurement of hot &amp; cold water Range : 0 - 11 LPM</li> <li>▪ Supply Tank: 300 x 300 x 450 mm storage tank one each for hot &amp; cold water.</li> <li>▪ Set of thermocouples.</li> <li>▪ Control panel: Digital Voltmeter: 0-300 Volt.</li> <li>▪ Digital Ammeter: 0-2 Amp.</li> <li>▪ Digital Temperature Indicator: 0-300°C (with multichannel switch)</li> <li>▪ On/Off switch, Mains Indicator etc.</li> </ul>	For B.Tech 4 <sup>th</sup> year Lab
06.	REFRIGERATION CONDITIONING T	<ul style="list-style-type: none"> <li>▪ Brazing Oxyacetylene Torch</li> <li>▪ Portable Gas charging Cylinder</li> <li>▪ Capillary Tube Gauge</li> <li>▪ Combination Pipe &amp; Machinist Vice</li> <li>▪ Table Vice</li> <li>▪ Capacitor Analyzer</li> <li>▪ Copper Tube Cutter</li> <li>▪ Mechanical Lever type Copper Tube Bender</li> <li>▪ Spring Copper Tube Bender</li> <li>▪ Flaring Tool</li> </ul>	For B.Tech 4 <sup>th</sup> year Lab

		<ul style="list-style-type: none"> <li>▪ Oxy-Acetylene Torch</li> <li>▪ Pinching Tool</li> <li>▪ Copper Tube Reamer</li> <li>▪ Ratchet Wrench (Clockwise &amp; Anticlockwise)</li> <li>▪ Crimping Tool</li> <li>▪ Rigid Copper Pipe Cutter</li> <li>▪ Charging Hose Pipe</li> <li>▪ Vacuum Pump</li> </ul>	
07.	REFRIGERATION CHARGING KIT	<ul style="list-style-type: none"> <li>▪ Rotary Vacuum Pump: High Vacuum rotary pump.</li> <li>▪ Refrigerant Gas Charging Cylinder: 2 Kg gas storage capacity.</li> <li>▪ Manifold: Flare connection header provided with compound coupling required for Vacuum in system, Gas Charging in system &amp; Filling of refrigerant in cylinder</li> <li>▪ Flaring Hand Shut Off valves: 3 Nos.</li> <li>▪ Filter Cum Drier: <math>\frac{1}{4}</math> Flare connection.</li> <li>▪ Compound Gauge: 30" - 0 - 150 PSI pressure range.</li> <li>▪ Anti Moisture Tube.</li> <li>▪ Charging Hose Pipe: 2 Nos.</li> <li>▪ Electric control panel consists of Voltmeter, ammeter, Extra service plug, Switches for vacuum pump &amp; service plug.</li> </ul>	For B.Tech 4 <sup>th</sup> year Lab

### Advanced Refrigeration Laboratory

**Laboratory In Charge: Dr K R Aharwal**

S. No.	Name of Equipment/ Instruments	Specifications	Specific Utility
01	Refrigeration system along with CO <sub>2</sub> scrubber, Ethylene generator Heat Exchanger Nitrogen generator, (Cold Storage)	<p>CO<sub>2</sub> Scrubbing capacity 50 kg per day with pneumatically operated valves.</p> <p>The ethylene generator is required for the food ripening in a cold room of dimensions 6*4*4meter and product load up to 15 MT.</p> <p>Intake Air capacity [m<sup>3</sup>/h] =190, Heat exchanger type- counter-flow, Heat recovery efficiency [%]= 82 up to 94, air temperature range [°C]= -25 up to +60.</p> <p>50 LPM at 60 psig pressure with purity above 95%. Auto Pressure Cut off Switch with Solenoid Valve, pressure gauge, micron filters, Electrical panel.</p>	To observe the storage life and quality of fruit and vegetables under controlled atmospheric condition. Also used to measure the performance of cold storage.

## Thermal Engineering Lab-1

**Laboratory In charge: Dr. Arvind Kumar**

S.NO	NAME OF EQUIPMENT/ INSTRUMENTS	SPECIFICATIONS	SPECIFIC UTILITY
1.	REVOMAX Boiler (THERMAX-RXA 06/2473) with Steam Turbine Test Rig	Steam output -600 kg/hr Heat output - 0.376 MW Steam pressure and temperature- 15 kg/cm <sup>2</sup> ,200°C	Conduct of UG and PG experiments on Power Plants

## Computer Aided Manufacturing Laboratory

**Laboratory In charges: Dr. C. M. Krishna and Dr. M. K. Pradhan**

Sl.No.	Name of Equipment/Instruments	Specifications	Specific Utility
1	Electric Discharge Machine Electronica Make	Smart CNC with S50 CNC generator	UG Practicals, UG, PG and PhD level research
2	Vertical Milling Machine (Automatic) Bhavya Machine Tools	Speeds up to 2000 rpm.	UG Practicals, UG and PG level research
3	CNC Milling Machine MTAB make	500x400x300, speeds 20 to 8000 rpm, Automatic Tool Changer with 20 tools	UG Practicals, UG, PG and PhD level research
4	Tool makers microscope	Up to 50x magnification	UG Practicals
5	Coordinate Measuring Machine FARO make	180 m work span	UG Practicals, PhD level research accessory

## Advanced CAD Laboratory

**Laboratory Incharge: Dr. Vilas Warudkar & Prof. Akhilesh Soni**

S. No.	Software	Specifications	Utility
1.	Creo 4.0 Software	50 user Licence	For 3 D modelling, 3 D drafting, assembly, 2 D Drawing and designing.

**H. O. D. (Mechanical Engineering)**