JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (MECHATRONICS)
Effective from Academic Year 2017-18 admitted Batch

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC -1	Applied Industrial Pneumatics	**25**	**75**	**4**	**0**	**0**	**4**
PC -2	Automation in Manufacturing	25	75	4	0	0	4
PC -3	Industrial Electrical & Electronics	25	75	4	0	0	4
PE -1	Precision Engineering Advanced CNC Technology Photo Voltaic & Solar Thermal Systems	25	75	3	0	0	3
PE-2	Control systems Instrumentation & Sensor Technology Programmable Logic Controller & Applications	25	75	3	0	0	3
OE-1	***Open Elective - I**	25	75	3	0	0	3
Laboratory I	Control Lab: (Pneumatic, Hydraulics, Electrical & Electronics Control)	25	75	0	0	3	2
Seminar I	Seminar - I	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC -4	Microcontroller & Applications	25	75	4	0	0	4
PC -5	Additive Manufacturing Technologies	25	75	4	0	0	4
PC -6	Industrial Robotics	25	75	4	0	0	4
PE -3	MEMS Design for Manufacturing & Assembly Fuzzy Logic & Neural Networks	25	75	3	0	0	3
PE-4	Intelligent Manufacturing Systems Computer Aided Metrology & Machine Vision Nanocomposites – Design & Synthesis	25	75	3	0	0	3
OE-2	***Open Elective - II**	25	75	3	0	0	3
Laboratory II	Applied Mechatronics Lab: (Robotics, CNC, PLC)	25	75	0	0	3	2
Seminar II	Seminar - II	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
Total	**100**	**100**	**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by OTHER departments.**

 # For Project review I, please refer 7.10 in R17 Academic Regulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – II Sem. (Mechatronics)

MICROCONTROLLERS & APPLICATIONS (PC – 4)

UNIT - I
Overview of 8 bit Microcontrollers- Intel, Motorola, and overview of the 8051 family- 8051 Architecture.

UNIT - II
8051 Assembly languages programming – addressing modes Instruction set- Jump, Loop+ CALL instructions & programs- Arithmetic instructions, Logic Instructions & Programs – Single bit instructions & Programming- I/o- Port programming.

UNIT - III
Timer/ Counter, programming of 8051 serial communication, interrupts.

UNIT - IV
Interfacing 8051 to external memory- semiconductor memory-Memory address decoding- Interfacing with external ROM-data memory space- Interfacing to 8255 Architecture of PIC microcontrollers features, interfacing of I/O devices with PIC Controllers. PIC 16c6x, 16c7x. 18x, 24x PIC memory organization.

UNIT - V
Applications – Interfacing of LCD to 8051- Interfacing ADC, Sensors- Interfacing steeper motor- Interfacing keyboard- Interfacing DAC to 8051. ARM Controllers Introduction to ARM controllers. Comparison between RISC & CISC processor. Versions & variants of ARM processor. Register model of ARM processor. Modes of Operation. Applications of ARM processor.

REFERENCE BOOKS:

1. Muhammad Ali Mazzid, Jancie Gillispe Mazid “The Microcontroller & Embedded Systems”, Pearson Education, 2000.
2. Julio Sanchez and Maria P. Canton, Microcontroller Programming-The Microchip PIC, CRC Press
3. Myke Predko “ Programming & Customizing the 8051”, Tata McGraw Hill, 1999
4. Raj Kamal “Embedded systems, Architecture, Programming and Design, “Tata McGraw Hill, 2003.
5. Kenneth J. Ayala, The 8051 Microcontroller, CENGAGE Publisher
6. Fernando E. Valdes-Perez and Ramon Pallas-Areny, Microcontrollers-Fundamentals and Applications with PIC, CRC Press
7. KVK Prasad, Embedded Real Time Systems, DearmTech Publishers

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ADDITIVE MANUFACTURING TECHNOLOGIES (PC – 5)

UNIT- I

Introduction: Introduction to Prototyping, Traditional Prototyping Vs Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC and other related technologies, Classification of RP, Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3D View, etc., Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT,STEP.

UNIT- II

RP Processes:

a) **Photopolymerization RP Processes**:- Stereolithography (SL), SL resin curing process, SL scan patterns, Microstereolithography, Applications of Photopolymerzation processes.
b) **Power Bed Fusion RP Processes**:- Stereolithography (SL), SL resin curing process, SL scan patterns, Microstereolithography. Applications of Photopolymerization Processes.
c) **Extrusion Based RP Processes**: Fused Deposition Modelling (FDM), Principles, Plotting and path control, Applications of Extrusion-Based Processes
d) **Printing RP Processes**: 3D printing (3DP), Research achievements in printing deposition, Technical challenges in printing, Printing process modeling, Application of Printing Process
e) **Sheet Lamination RP Processes**: Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications
f) **Beam Deposition RP Processes**: Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Processing-structure-properties, relationships, Benefits and drawbacks.

UNIT - III

Rapid tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods

UNIT- IV

Reverse engineering: Reverse Engineering (RE) Methodologies and Techniques, Selection of RE systems, RE software, RE hardware, RE in product development

UNIT - V

Errors in RP processes and applications: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc., Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP

REFERENCE BOOKS:

1 Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010.
2 Ian Gibson., David W Rosen., Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
3 Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
4 D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer, 2011
5 Amit Bandyopadhyay, Additive Manufacturing, CRC Press 2015.
6 T. S. Srivatsan, T. S. Sudharshan, CRC Press 2015

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – II Sem. (Mechatronics)

INDUSTRIAL ROBOTICS (PC – 6)

UNIT - I:
Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.
Control System and Components: basic concept and modals controllers control system analysis, robot actuators and feedback components (sensors): Internal & External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics , Power Transmission Systems.

UNIT - II:
Motion Analysis and Control: Manipulator kinematics, position representation Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward & Inverse transformations, problems on planar & spatial manipulators, Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated & Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending.

UNIT - III:
Robot Dynamics: Lagrange – Euler & Newton Euler formulations, problems on two link planar manipulators, configuration of robot controller.
End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.
Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT - IV:
Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations.
Robot Languages: Textual robot languages, Generation, Robot language structures, Elements and functions.

UNIT - V:
Robot Cell Design and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.
Robot Applications: Material transfer, Machine loading/unloading. Processing operations, Assembly and Inspection, Future Applications.

REFERENCE BOOKS:

1. Introduction to Robotics Mechanics & Control/ John J.Craig/Pearson
2. Industrial robotics / Mikell P. Groover / McGraw Hill.
3. Modelling & Ctrl of Robot Manipulators/L. Sciavicco & B. Siciliano/Springer
4. Robot Technology Fundamentals, James G. Keramas, CENGAGE
5. Robotics / K.S. Fu / McGraw Hill.
6. Robot Analysis/Lung Wen Tsai/John Wiley & Sons
7. Robotics & control/R K Mittal & I J Nagrath/ Tata McGraw Hill
8. Fundamentals of Robotics/Robert J. schilling/PHI
9. Robotics by saha/TMG
10. Robotic Engineering/ Richard D. Klafter, Thomas A. Chmielewski/PHI

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – II Sem. (Mechatronics)

MEMS (Professional Elective - 3)

UNIT - I:
Overview and working principles of MEMS and Microsystems: MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

UNIT - II:
Engineering Science for Microsystems Design and Fabrication: Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

UNIT - III:
Engineering Mechanics for Microsystems Design: Static Bending of Thin plates, Mechanical Vibration, Thermo mechanics , Fracture Mechanics, Thin- Film Mechanics, Overview of Finite Element Stress Analysis

UNIT - IV:
Thermo Fluid Engineering & Microsystems Design: Overview of Basics of Fluid Mechanics in Macro and Mesoscales, Basic equations in Continum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid flow in Sub micrometer and Nano scale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

UNIT - V:
Materials for MEMS & Microsystems and their fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

REFERENCE BOOKS:

1. Tia-Ran Hsu, MEMS & Microsystems. Design & Manufacturing, TMH 2002
2. Maluf, M., “An Introduction to Microelectromechanical Systems Engineering”. Artech House, Boston 2000
3. Trimmer , W.S.N., “Micro robots and Micromechanical Systems”, Sensors & Actuators, Vol 19, 1989
4. Trim., D. W., “Applied Partial Differential Equations”., PWS-Kent Publishing, Boston, 1990
5. Stephen D. Senturia, Microsystem Design, Springer Publishers

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M. Tech – I Year – II Sem. (Mechatronics)

DESIGN FOR MANUFACTURING AND ASSEMBLY (PROFESSIONAL ELECTIVE - 3)

UNIT - I:

Introduction: Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of design Ling for economical production - creativity in design.

Materials: Selection of Materials for design Developments in Material technology - criteria for material selection - Material selection interrelationship with process selection process selection charts.

UNIT - II:

Machining Process: Overview of various machining processes - general design rules for machining - Dimensional tolerance and surface roughness - Design for machining - Ease - Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

Metal Casting: Appraisal of various casting processes, selection of casting process, - general design considerations for casting - casting tolerances - use of solidification simulation in casting design - product design rules for sand casting.

UNIT - III:

Metal Joining: Appraisal of various welding processes, Factors in design of weldments - general design guidelines - pre and post treatment of welds - effects of thermal stresses in weld joints - design of brazed joints.

Forging - Design factors for Forging - Closed dies forging design - parting lines of die5 drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

UNIT- IV

Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT - V:

Design of Manual Assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

REFERENCES:

1. Assembly Automation and Product Design/ Geoffrey Boothroyd/ Marcel Dekker Inc., NY, 1992.
2. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed. 2000.
3. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.
4. Computer Aided Assembly London/ A Delbainbre/.
5. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – II Sem. (Mechatronics)

FUZZY LOGIC & NEURAL NETWORKS (Professional Elective - 3)

UNIT- I
Fuzzy Set Theory and Fuzzy Logic Control:
Basic concepts of fuzzy sets- Operations on fuzzy sets- Fuzzy relation equations- Fuzzy logic control- Fuzzification –Defuzzificatiuon- Knowledge base- Decision making logic- Membership functions – Rule base.

UNIT- II
Adaptive Fuzzy Systems:
Performance index- Modification of rule base0- Modification of membership functions- Simultaneous modification of rule base and membership functions- Genetic algorithms-Adaptive fuzzy system- Neuro fuzzy systems.

UNIT- III
Artificial Neural Networks:
Introduction- History of neural networks- multilayer perceptions- Back propagation algorithm and its Variants- Different types of learning, examples.

UNIT- IV
Mapping and Recurrent Net works:
Counter propagation –Self organization Map- Congnitron and Neocognitron- Hopfield Net- Kohonnen Nets- Grossberg Nets- Art-I, Art-II reinforcement learning

UNIT- V
Case Studies:
Application of fuzzy logic and neural networks to Measurement- Control- Adaptive Neural Controllers – Signal Processing and Image Processing

TEXT BOOK:

1. Vallum B. R And Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB Publications, New Delhi, 1996

REFERENCE BOOKS:

1. Fuzzy logic &Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
2. Neural Networks for control, Millon W. T, Sutton R.S and Werbos P.J, MIT Press 1992
3. Fuzzy sets Fuzzy logic, Klir, G.J anfd Yuan B.B Prentice Hall of India Pvt. Ltd.,, New Delhi
4. Neural Networks and Fuzzy systems, Kosko.. Prentice hall of India Pvt. Ltd.,, New Delhi 1994
5. Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996
6. Introduction to Artificial Neural systems, Zurada J. M Jaico Publishing House, New Delhi 1994

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INTELLIGENT MANUFACTURING SYSTEMS (Professional Elective - 4)

UNIT - I:
Computer Integrated Manufacturing Systems – Structure and functional areas of CIM system - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM.
Manufacturing Communication Systems – MAP/TOP, OSI Model, Data Redundancy, Top-down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing – System Components, System Architecture and Data Flow, System Operation.

UNIT - II:
Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT - III:
Machine Learning – Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing

UNIT - IV:
Automated Process Planning – Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning
Knowledge Based System for Equipment Selection (KBSES) – Manufacturing system design, Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KBSES.

UNIT - V:
Group Technology: Models and Algorithms – Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation – Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology - Group Technology in Automated Manufacturing System, Structure of Knowledge based system for group technology (KBSGT) – Data Baswe, Knowledge Base, Clustering Algorithm.

REFERENCES:

1. Intelligent Manufacturing Systems/ Andrew Kusiak/Prentice Hall.
2. Artificial Neural Networks/ Yagna Narayana/PHI/2006
3. Automation, Production Systems and CIM / Groover M.P./PHI/2007
4. Neural networks: A comprehensive foundation/ Simon Haykin/ PHI.
5. Artificial neural networks/ B. Vegnanarayana/PHI
6. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
7. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
8. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

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COMPUTER AIDED METROLOGY & MACHINE VISION (Professional Elective - 4)

UNIT - I

Coordinate Measuring Machine: Evaluation of Measurement-Coordinate Measuring Machines- non-Cartesian CMMs- Accessory elements- Application software- Performance evaluations- Temperature fundamentals- Environmental control- Accuracy enhancement- Applications –Measuring integration of CMM and computers.

UNIT - II

Laser in Measurements: Laser source- Types, Characteristics and its application in measurement, - LASER Interferometer for measurement of flatness and displacement- LASER alignment- LASER micrometer- Tool wear online and in process measurement of diameter, Roundness measurement using LASER- Opto-Electric devices- Contact and non-contact types- Application of online and in process monitoring systems.

UNIT - III

Quality Control & Quality Assurance: In-process inspection and online sensing, Automated inspection techniques total Quality Control (TQC)- Quality Assurance (QA)- POKA-YOKE statistical evaluation of data using computer, Total Quality Management(TQM)

UNIT - IV

Machine Vision and its Application: Shape identification –edge detecting techniques- Normalization- gray scale correction- template techniques- measurement of length and diameters, surface roughness using machine vision system- interfacing Robot and machine vision system- Industrial applications.

UNIT - V

Statistical Process Control: Introduction, Objectives, setting control limits, Real Time Control Charts, control limits, Bell curve distribution.

REFERENCE BOOKS:

1. Computers as Components, Principles of Embedded Computers Systems Design, Wayne Wolf Morgan
2. J. Watson, Opto- electronics, Van Nostrand, Reinhold (UK) Co. Ltd, 1988
3. Taguchi. G. L Syed et al. Quality Engineering in product Systems, McGraw Hill, 1980
4. John bank, : Essence of TQM, Prentice Hall of India Pvt, 1990
5. Machining and CNC Technology – Michael Fitz Patrick, McGraw Hill Publication.

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NANOCOMPOSITES - DESIGN AND SYNTHESIS (Professional Elective – 4)

Course Objective:
This course intended to cover nanocomposites, reinforcing nanostructures dispersed in various matrix materials like polymers, ceramics, metals, etc, The subject covers mainly the synthesis methods, modeling and evaluation of nanocomposites.

Course Outcome:
- To synthesize and evaluate nanostructure reinforce matrix material
- To understand the importance of various nanomaterial matrix
- To discuss various application including aerospace applications

UNIT – I
Introduction to Nanocomposites, Composite material, Mechanical properties of Nano composite material: stress - strain relationship, toughness, strength, plasticity.

UNIT – II
Ceramic-Metal Nanocomposites, Ceramic based nanoporous composite, Metal matrix nanocomposites, Polymer-based nanocomposites Carbon nanotube based nanocomposites and Natural nanobiocomposites, Biomimetic nanocomposites and Biologically inspired nanocomposites.

UNIT – III
Synthesis methods for various nanocomposite materials: mechanical alloying, thermal spray synthesis etc. Nano composites for hard coatings; DLC coatings; Thin film nanocomposites; Modeling of nanocomposites.

UNIT – IV
Types of indentation: Oliver & Pharr, Vickers indentation process, Nano Indentation by AFM

UNIT – V
Processing of polymer nanocomposites, properties of nanocomposites, Infiltration techniques, stir mixing, Extrusion method, Exfoliation & intercalation, Solution casting method, impregnation techniques: Hot melt impregnation, solution impregnation.

REFERENCE BOOKS:

1. Nanocomposite Science & Technology by P.M. Ajayan, L. S. Schadler and P.V. Braun, Wiley-VCH GmbH Co.
2. Introduction to Nano Technology by Charles. P. Poole Jr and Frank J. Owens; Wiley India Pvt Ltd.
3. Nanotechnology, A gentle introduction to the next big idea by Mark Ratner, Daniel Ratner Pearson education.
4. Polyoxometalate Chemistry for Nano- Composite Design
5. Encyclopedia of Nanotechnology by H. S. Nalwa
6. Encyclopaedia of Nano Technology by M. Balakrishna rao and K. Krishna Reddy, Vol I to X Campus books.

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APPLIED MECHATRONICS LAB
(ROBOTICS, CNC, PLC)

LIST OF EXPERIMENTS

Any TEN of the following Experiments

1. Study and operation of CNC lathe.
2. Study and CNC milling machine.
3. Preparation of testing of typical part programs on CNC Trainer.
4. Preparation of testing of typical part programs on CNC milling machine.
5. Exercises using CAM software.
6. Training on Desktop Tutors.
7. Part program generation through G and M codes for Turning, Boring, Drilling, Reaming and Milling.
8. Development of tool path simulation by setting tool offsets for multi-operations (Combinations of above operations).
9. Study of various cutting tools used in above CNC Machines such as twist drill, End Mill cutter, and other Standard tooling.
10. Machining of various Components by generation of CNC code by (CAM Packages).
11. Interfacing the CNC Codes to the CNC Lathe and mill through RS232.
12. Robot Programming.
13. PLC Programming for operation of motor with fan, buzzer, lamp.

LIST OF EQUIPMENTS

1. CNC Lathe Machine with accessories like 8 Station Automatic Tool Holders, Pneumatic Chuck and Automatic Door Opening, 3-Jaw Chuck, Internal and External Tool Holder, Desktop Tutor and Software.
2. CNC Milling Machine with Accessories like 6 Station Automatic tool Holders, Collets, End Milling Cutters, Hydro-pneumatic Control Chuck, Automatic Door Opening, Desktop tutors and Software.
3. 5-Axis Robot with Teach Pendent along with accessories
4. CAM Software for turning and milling modules.
5. Programmable Logic Controller setup with software.