

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M.Tech in AUTOMATION
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	Automation in Manufacturing	25	75	4	0	0	4
PC-2	Additive Manufacturing Technologies	25	75	4	0	0	4
PC-3	Industrial Robotics	25	75	4	0	0	4
PE-1	1. Intelligent Manufacturing Systems 2. Performance Modeling And Analysis of Manufacturing Systems 3. MEMS & Micro Systems : Design And Manufacture	25	75	3	0	0	3
PE-2	1. Special Manufacturing Processes 2. Advanced Mechatronics 3. Neural Network & Fuzzy logics	25	75	3	0	0	3
OE-1	*Open Elective – I	25	75	3	0	0	3
Laboratory I	Manufacturing simulation & Precision Engineering lab	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	Modern control Engineering	25	75	4	0	0	4
PC-5	Design of Hydraulic and Pneumatic Systems	25	75	4	0	0	4
PC-6	Intelligent Instrumentation And Manufacturing	25	75	4	0	0	4
PE-3	1. Optimization Techniques and Applications 2. Vibration Analysis & Condition Monitoring 3. Design for Manufacturing and Assembly	25	75	3	0	0	3
PE4	1. Artificial Intelligence And Expert Systems 2. Flexible Manufacturing Systems 3. Concurrent Engineering & Product Life Cycle Management	25	75	3	0	0	3
OE-2	*Open Elective - II	25	75	3	0	0	3
Laboratory II	Automation & Robotics Lab	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
I Year – II Sem. M.Tech (Automation)

MODERN CONTROL ENGINEERING (Professional Core – 4)

UNIT - I

Mathematical modelling of dynamic systems, Transient response of second and higher order systems, Root locus and Bode plots, Lead, lag and Lead-Lag circuits.

UNIT - II

State variables, Transition matrix, Transformation of Variables, Diagonalization of matrix, Canonical form.

UNIT - III

State Variable feedback systems, Closed loop pole zero assignment, observability and controllability.

UNIT - IV

Introduction to non linear systems, Phase plane method.

UNIT – V

Stability analysis, Routh – Hurwitz Criterion, Nyquist method, Lyapunov method of stability analysis.

REFERENCES:

1. Control Systems Principles and Design/ Gopal M/ Tata McGraw Hill Company, 1998.
2. Automatic Control Engineering/ Francis Raven H/ Tata Mc Graw Hill Company/ 5th Edition/1995.
3. Digital Control of Dynamic Systems/ Franklin G.F. and Powell J.D./ Addison- Wesley, 1980.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I year - II Sem. M.Tech (Automation)

DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS (Professional Core – 5)

UNIT – I:

Oil hydraulic systems Hydraulic pumps, types and construction details, sizing and selection.
Direction control valves, flow and pressure control valves.

UNIT – II:

Linear actuators types Piston rod design sizing and selection, Rotary actuators, hydraulic reservoir accumulators.

UNIT – III:

Design of hydraulic circuits, seals and packings, hydraulic servo techniques, cylinders and air motors.

UNIT – IV:

Sequencing and synchronizing circuits, accumulator, low cost automation Hydro circuits, accumulators, Hydro pneumatic circuits principles of pneumatic circuit design.

UNIT – V:

Maintenance and trouble shooting of hydraulic and pneumatic circuits, components, PLC Automation and uses of Microprocessors.

REFERENCES:

1. Oil Hydraulic Systems/ S.R. Majumdar/ Tata Mc. Graw Hill
2. Pneumatic systems, principles and maintenance/ S.R. Majumdar/Tata McGraw Hill
3. Hydraulic and pneumatics/ Andrew Darr/ Jaico Publishing Hoise.
4. Fluid power with applications/ Antony Esponssito/ Prentice Hall

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year - II Sem. M.Tech (Automation)

INTELLIGENT INSTRUMENTATION AND MANUFACTURING (Professional Core – 6)

UNIT-I

Introduction - Introduction of intelligent instrumentation, Historical Perspective, Current status, software based instruments.

Virtual Instrumentation: Introduction to graphical programming, data flow & graphical programming techniques, advantage of VI techniques, VIs and sub VIs loops and charts, arrays, clusters and graphs, case and sequence structure, formula nodes, string and file I/O Code Interface Nodes and DLL links.

UNIT- II

Data Acquisition Method, Analog and Digital IO, Counters, Timers, Basic ADC design, interfacing methods of DAQ hardware, software structure, .use of simple and intermediate VIs. Use of Data Sockets for Networked communication and controls.

UNIT- III

PC Hardware Review and Instrumentation Buses, Structure, timing, interrupts, DMA, operating system, ISA, PCI, USB, PCMCIA Buses. IEEE488.1 & 488.2 serial Interfacing -RS 232C, RS422, RS423, RS485, USB, VXI, SCXI, P3JJ.

UNIT- IV

Analysis Techniques: DSP software, Measurement, filters and wavelets, windows, curve fitting probability & statistics.

Communication: Basis networking methods and their applications in instrumentation, use of Data sockets for distributed control.

UNIT-V

Components of Knowledge Based Systems: Basic components of knowledge based system, knowledge Representation, comparison of knowledge Representation Schemes, Inference Engine, knowledge acquisition Machine Learning - concept of Artificial intelligence, conceptual learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, types of Neural Networks^ applications in manufacturing.

REFERENCES:

1. Intelligent Instrumentation/ G.C. Barney/Prentice Hall, 1995ce:
2. Lab VIEW For everyone/ Lisa, K. Wells & Jeffery Travis/ Prentice Hall, 1997
3. Principles of measurement and Instrumentation/ A.S. Morris/Prentice Hall, 1993.
4. P.C. Interfacing for data Acquisition & Process Control/ S. Gupta/, 2nd Edition/Instrument Society of America, 1994
5. Lab VIEW Graphical Programming/ Gray Johnson/ 2nd Edition/Tata Mc Graw Hill, 1997

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year - II Sem. M.Tech (Automation)

OPTIMIZATION TECHNIQUES AND APPLICATIONS (Professional Elective – 3)

UNIT- I

Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods:- Uni-modal function, elimination methods, ,, Fibonacci method, golden section method, interpolation methods – quadratic & cubic interpolation methods.

UNIT-II

Multi variable non-linear unconstrained optimization: Direct search method – Univariate method - pattern search methods – Powell's- Hook -Jeeves, Rosenbrock search methods- gradient methods, gradient of function, steepest decent method, Fletcher Reeves method, variable metric method.

UNIT- III

Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.

Simulation – Introduction – Types- steps – application – inventory – queuing – thermal system

UNIT -IV

Integer Programming: Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method

Stochastic programming:

Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution- stochastic linear, dynamic programming.

UNIT- V

Geometric Programming: Polynomials – arithmetic - geometric inequality – unconstrained G.P- constrained G.P (<= TYPE ONLY)

Non-traditional optimization Techniques: Genetic Algorithms-Steps-Solving simple problems- Comparisons of similarities and dissimilarities between traditional and non-traditional techniques-Particle Swarm Optimization (PSO)- Steps(Just understanding)-Simulated Annealing-Steps-Simple problems.

REFERENCES:

1. Optimization theory & Applications / S.S. Rao / New Age International.
2. Engineering Optimization-Kalyan Deb/ PHI
3. Introductory to operation Research / Kasan & Kumar / Springar
4. Optimization Techniques theory and practice / M.C. Joshi, K.M. Moudgalya/ Narosa Publications
5. Operation Research / H. A. Taha /TMH
6. Optimization in operations research / R. L Rardin
7. Optimization Techniques /Benugundu & Chandraputla / Pearson Asia

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year - II Sem. M. Tech (Automation)

VIBRATION ANALYSIS AND CONDITION MONITORING (Professional Elective – 3)

UNIT - I

Causes and effects of vibration, Vibration of single Degree and Multi Degree of freedom systems. Steady state and transient characteristics of Vibration.

UNIT - II

Introduction to Condition Monitoring, Failures types, investigation and occurrences. Causes of failure, Characteristics of vibration ~SHM, Periodic motion, Displacement, Velocity and acceleration. Peak to peak & RMS, Linear and logarithmic scales and phase angle.

UNIT - III

Vibration measuring instruments, vibration transducers, signal conditioning elements. Display and recording elements. Vibration meters and analyzers.

UNIT - IV

Condition monitoring through vibration analysis. Frequency analysis, Filters, Vibration signature of active systems, vibration limits and standards. Contaminant analysis, SOAP and other contaminant monitoring techniques,

UNIT-V

Special vibration measuring techniques Change in sound method, Ultrasonic measurement method, Shock pulse measurement, Kurtosis, Acoustic emission monitoring, Cepstrum analysis, Modal analysis, critical speed analysis, shaft -orbit & position analysis..

REFERENCES:

1. Mechanical Fault Diagnosis and Condition Monitoring/ Collacott. R.A./ Chapman & Hall, London, 1982,
2. Introduction to Machinery Analysis and Monitoring/ John S. Mitchell/ Perm Well Books, Perm Well Publishing Company, Tulsa, Oklahoma,1993,
3. Vibration Measurement and Analysis/ Nakra. B.C .Yadava, G. S. and Thuested .L./ National Productivity Council, New Delhi, 1989.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year -II Sem. M.Tech (Automation)

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 Anstony Knight/CRC Press/2010

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I Year - II Sem. M.Tech (Automation)

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS (Professional Elective – 3)

UNIT- I

Artificial Intelligence: Introduction, definition, underlying assumption, important of AI & related fields
State space representations, defining a problem, production systems and its characteristic, search and control strategies - Introduction, preliminary concepts, examples of Search problems.

UNIT- II

Uniformed or Preliminary Concepts: Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques - Generate and Test, Hill climbing, best first search, problem, reduction, constraint satisfaction, Means - Ends Analysis.

Knowledge Representation Issues: Representations and Mapping, Approaches, Issues in Kr, Types of Knowledge procedural Vs Declarative, Logic programming. Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic.

UNIT- III

Use of Predicate Logic: Representing Simple facts, Instance and is a relationships, Syntax and Semantics for propositional logic, FOPL, and properties of Wffs, conversion to casual form, Resolution Natural deduction

Statistical and Probabilistic Reasoning : Symbolic reasoning under uncertainly, Probability and Bayes' theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster - Shafer Theory, Fuzzy Logic.

UNIT- IV

Expert Systems: Introduction, Structure and uses, Representing and using domain knowledge, Expert System shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

UNIT-V

Introduction to Knowledge Acquisition: Types of learning, General Learning model, and performance measures.

Typical Expert Systems: MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF etc.

Introduction to Machine Learning: Perceptions, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

REFERENCES:

1. Artificial intelligence / Elaine Rich & Kevin Knight/ M/H 1983.
2. Artificial intelligence in business, Science & Industry / Wendry B.Ranch, Vol II application/ PH/1985
3. A guide to expert systems / Waterman, D. A., Addison/ Wesley inc. 1986.
4. Building expert systems / Hayes, Roth, Waterman/ D.A(ed) AW /1983.
5. Designing expert systems/ wets, S.M. and Kulliknowske/ London champion Hull 1984.

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I Year -II Sem. M.Tech (Automation)

FLEXIBLE MANUFACTURING SYSTEMS (Professional Elective – 4)

UNIT- I:

Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS. Knowledge based scheduling. The Development of Manufacturing systems. Pallets, Fixtures and Machines, work handling system layouts.

UNIT - II:

Hierarchy of computer control. Supervisory computer. System Management, Tool Management, Simulation and Analysis in the Design of FMS.

UNIT - III:

Software for simulation and database of FMS. Specification and selection, trends, application of simulation software. Simulation Modeling for FMS.

UNIT - IV:

Manufacturing data systems data flow, CAD/CAM considerations. Planning FMS database, just in time characteristics, Pull method, quality small lot sizes, work station loads, close supplier ties, flexible workforce — line flow strategy. Simulation for FMS Design.

UNIT - V:

Preventive maintenance. Karban system, implementation issues. Economic justification of FMS; Artificial Intelligence in the Design of FMS.

REFERENCES:

1. Joseph Talavage, Roger G. Hannam “ Flexible Manufacturing systems in Practice (Applications, Design and simulation)” CRC Press
2. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.
3. Production System I3eyond Large Scale Production/ Talichi Ohno/ Toyota Productivity Press India Pvt. Lid.
4. Flexible Manufacturing Systems/ H K Shivanand/New Age International/2006
5. S.R.Deb “Robotics Technology and Flexible Automation”McGraw-Hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I Year - II Sem. M.Tech (Automation)

CONCURRENT ENGINEERING AND PRODUCT LIFE CYCLE MANAGEMENT
(Professional Elective – 4)

UNIT - I:

Introduction: Extensive definition of Concurrent Engineering(CE),CE design methodologies, Review of CE techniques like DFM (Design for manufacture), DFA(Design for assembly),QFD (Quality function deployment), RP (Rapid prototyping), TD (Total design), for integrating these technologies, organizing for CE, CE tool box, Collaborative product development.

UNIT - II:

Use of Information Technology: IT Support Solid modeling, product data management, Collaborative product commerce, Artificial Intelligence, expert systems, Software hardware component design.

UNIT - III:

Design Stage: Lifecycle design of products, opportunities for manufacturing enterprises, Modality of Concurrent engineering design, Automated analysis idealization control, CE in optimal structural design, Real time constraints.

UNIT - IV:

Need for PLM: Importance of PLM, Implementing of PLM, Responsibility for PLM, Benefits to different managers, Components of PLM, Emergence of PLM, Life cycle problems to resolve, Opportunities to seize.

UNIT - V:

Components of PLM: components of PLM, Product lifecycle activities, Product organizational structure, Human resources in product lifecycle, Methods, techniques, practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards.

REFERENCES:

1. Integrated Product Development / M. M .Anderson and L. Hein/ IFS Publications
2. Design for Concurrent Engineering/ J Cleetus/ CE Research Centre, Morgantown,
3. Concurrent Engineering Fundamentals/ Prasad / Prentice hall India Integrated Product Development
4. Concurrent Engineering in product Design and Development/ I. Moustapha / New age International
5. Product Life Cycle Management/ John Stark/ Springer –Verlag/ UK
6. Product Lifecycle Management/ Michael Grives/ Mc Graw Hill
7. Concurrent Engineering: Automation tools and Technology/Andrew Kusiak/ Wiley Eastern Technology.

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I Year - II Sem. M.Tech (Automation)

AUTOMATION AND ROBOTICS LAB

1. Principles of automation
2. Limit stops and CAM control devices
3. Pneumatic, hydraulic, electrical systems in automation
4. Microprocessor applications in automated systems.
5. CNC machines and programming.
6. Robotics Systems and Programming
7. Automated transfer devices.
8. Training on Programmable Logic Controllers