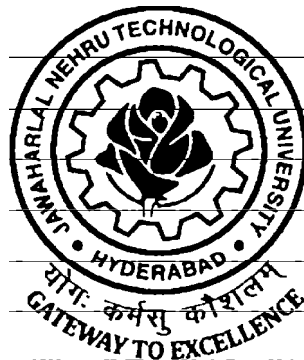


**ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS**

**M.TECH
MECHATRONICS**

(Applicable for the batches admitted from 2013-14)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
KUKATPALLY, HYDERABAD – 500 085.**

ACADEMIC REGULATIONS R13 FOR M. TECH. (REGULAR) DEGREE COURSE**Applicable for the students of M. Tech. (Regular) Course from the Academic Year 2013-14 and onwards**

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M. TECH. DEGREE

- 2.1 A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after four academic years of course work.
- 2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his admission, shall forfeit his seat in M. Tech. course.
- 2.3 The student shall register for all 88 credits and secure all the 88 credits.
- 2.4 The minimum instruction days in each semester are 90.

3.0 A. COURSES OF STUDY

The following specializations are offered at present for the M. Tech. course of study.

1. Advanced Manufacturing Systems
2. Aerospace Engineering/ Aeronautical Engineering
3. Automation
4. Biomedical Signal Processing and Instrumentation
5. Bio-Technology
6. CAD/CAM
7. Chemical Engineering
8. Communication Systems
9. Computer Networks
10. Computer Networks and Information Security
11. Computer Science
12. Computer Science and Engineering
13. Computers and Communication Engineering.
14. Construction Management
15. Control Engineering
16. Control Systems
17. Cyber Forensic / Cyber Security & Information Technology
18. Design for Manufacturing/ Design and Manufacturing
19. Digital Electronics and Communication Engineering.
20. Digital Electronics and Communication Systems
21. Digital Systems and Computer Electronics
22. Electrical Power Engineering
23. Electrical Power Systems
24. Electronics & Instrumentation

-
25. Electronics and Communication Engineering
 26. Embedded Systems
 27. Embedded Systems and VLSI Design
 28. Energy Systems
 29. Engineering Design
 30. Environmental Engineering
 31. Geoinformatics and Surveying Technology
 32. Geotechnical Engineering.
 33. Heating Ventilation & Air Conditioning.
 34. Highway Engineering
 35. Image Processing
 36. Industrial Engineering and Management
 37. Information Technology
 38. Infrastructure Engineering
 39. Machine Design
 40. Mechatronics.
 41. Microwave & Radar Engineering
 42. Nano Technology
 43. Neural Networks
 44. Parallel Computing
 45. Power and Industrial Drives
 46. Power Electronics
 47. Power Electronics and Electrical Drives
 48. Power Engineering and Energy Systems
 49. Power Plant Engineering & Energy Management
 50. Power System Control and Automation
 51. Power System with Emphasis H.V. Engineering / H.V. Engineering
 52. Production Engineering.
 53. Real Time Systems
 54. Software Engineering
 55. Structural Engineering
 56. Systems & Signal Processing
 57. Thermal Engineering.
 58. Transportation Engineering
 59. VLSI
 60. VLSI and Embedded System/ Electronics Design Technology
 61. VLSI Design
 62. VLSI System Design
 63. Web Technologies
 64. Wireless and Mobile Communication

and any other course as approved by the University from time to time.

3.0 B. Departments offering M. Tech. Programmes with specializations are noted below:

<p>Civil Engg.</p>	<p>Construction Management Environmental Engineering Geoinformatics and Surveying Technology Geotechnical Engineering Highway Engineering Infrastructure Engineering Structural Engineering Transportation Engineering</p>
<p>EEE</p>	<p>Control Engineering Control Systems Electrical Power Engineering Electrical Power Systems Power and Industrial Drives Power Electronics Power Electronics and Electrical Drives Power Engineering and Energy Systems Power Plant Engineering & Energy Management Power System Control and Automation Power System with Emphasis H.V. Engineering / H.V. Engineering</p>
<p>ME</p>	<p>Advanced Manufacturing Systems Automation CAD/CAM Design for Manufacturing/ Design and Manufacturing Energy Systems Engineering Design Heating Ventilation & Air Conditioning Industrial Engineering and Management Machine Design Mechatronics. Power Plant Engineering & Energy Management Production Engineering Thermal Engineering.</p>
<p>ECE</p>	<p>Biomedical Signal Processing and Instrumentation Communication Systems Computers and Communication Engineering. Digital Electronics and Communication Engineering. Digital Electronics and Communication Systems Digital Systems and Computer Electronics Electronics & Instrumentation Electronics and Communication Engineering Embedded Systems Embedded Systems and VLSI Design</p>

	Microwave & Radar Engineering Systems & Signal Processing VLSI VLSI and Embedded System/ Electronics Design Technology VLSI Design VLSI System Design Wireless and Mobile Communication
CSE	Computer Networks Computer Networks and Information Security Computer Science Computer Science and Engineering Cyber Forensic / Cyber Security & Information Technology Image Processing Information Technology Neural Networks Parallel Computing Real Time Systems Software Engineering Web Technologies
Aeronautical Engg.	Aerospace Engineering / Aeronautical Engineering
Bio-technology	Bio-Technology
Chemical Engg.	Chemical Engineering
Nano Technology	Nano Technology

4.0 ATTENDANCE

The programs are offered on a unit basis with each subject being considered a unit.

- 4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.
- 4.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.
- 4.3 Shortage of Attendance below 65% in aggregate shall not be condoned.
- 4.4 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class and their registration shall stand cancelled.
- 4.5 A prescribed fee shall be payable towards condonation of shortage of attendance.
- 4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- 4.7 A candidate shall put in a minimum required attendance at least in three (3) theory subjects in the present semester to get promoted to the next semester. In order to qualify for the award of the M. Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.
- 4.8 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the previous semester including the days of attendance in sports, games, NCC and NSS activities.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

- 5.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for a total duration of 120 minutes with Part A as compulsory question (16 marks) which consists of four sub-questions and carries 4 marks each and Part B with 3 questions to be answered out of 5 questions each question for 8 marks. If any candidate is absent from any subject of a mid-term examination, an on-line test will be conducted for him by the University. The details of the Question Paper pattern for End Examination (Theory) is given below:
- The End semesters Examination will be conducted for 60 marks which consists of two parts viz. i).Part-A for 20 marks, ii). Part –B for 40 marks.
 - Part-A is compulsory question where it consists of five questions one from each unit and carries four marks each. This will be treated as Question 1.
 - Part-B consists of five Questions (numbered from 2 to 6) carries 8 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an “either” “or” choice (that means there will be two questions from each unit and the student should answer only one question)
- 5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded based on the day-to-day performance as Internal Marks.
- 5.3 There shall be two seminar presentations during I year I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 5.4 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects he has studied during the M. Tech. course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voce.
- 5.5 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.
- 5.6 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.5) he has to reappear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and so has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled.
- 5.7 In case the candidate secures less than the required attendance in any subject, he shall not be permitted to write the End Examination in that subject. He shall re-register the subject when next

offered.

- 5.8 Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be another Laboratory Teacher.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

- 6.1 A Project Review Committee (PRC) shall be constituted with Principal as Chairperson, Heads of all the Departments offering the M. Tech. programs and two other senior faculty members.

- 6.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

- 6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for approval. Only after obtaining the approval of the Departmental Academic Committee can the student initiate the Project work.

- 6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Departmental Academic Committee. However, the Departmental Academic Committee shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

- 6.5 A candidate shall submit his status report in a bound-form in two stages at least with a gap of 3 months between them.

- 6.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Principal through Head of the Department and make an oral presentation before the PRC.

- 6.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

- 6.8 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

- 6.9 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

- 6.10 If the report of the examiner is favourable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work as one of the following:

- A. Excellent
- B. Good
- C. Satisfactory
- D. Unsatisfactory

The Head of the Department shall coordinate and make arrangements for the conduct of Viva- Voce examination.

If the report of the Viva-Voce is unsatisfactory, the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva- Voce examination, he will not be eligible for the award of the degree.

7.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70% but not less than 60%
Second Class	Below 60% but not less than 50%
Pass Class	Below 50% but not less than 40%

The marks in internal evaluation and end examination shall be shown separately in the memorandum of marks.

8.0 WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

9.0 TRANSITORY REGULATIONS

- 9.1 Discontinued, detained, or failed candidates are eligible for admission to two earlier or equivalent subjects at a time as and when offered.
- 9.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R13 academic regulations.

10. GENERAL

- 10.1 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
- 10.2 The academic regulation should be read as a whole for the purpose of any interpretation.
- 10.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- 10.4 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	<i>If the candidate:</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7. 8.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

9.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
10.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
11.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
12.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
 - (i) A show cause notice shall be issued to the college.
 - (ii) Impose a suitable fine on the college.
 - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH - MECHATRONICS

COURSE STRUCTURE AND SYLLABUS

I Year I Semester

Code	Group	Subject	L	P	Credits
		Applied Industrial Pneumatics	3	-	3
		Applied Industrial Hydraulics	3	-	3
		Automation in Manufacturing	3	-	3
		Industrial Electrical & Electronics	3	-	3
	Elective – I	Precision Engineering Advanced CNC Technology Electro-Optic Systems	3	-	3
	Elective – II	Control Systems Instrumentation & Sensor Technology Power Electronics & Drives	3	-	3
		Control Lab: (Pneumatic, Hydraulics, Electrical & Electronics Control)	-	3	2
		Seminar	-	-	2
		Total Credits	18	3	22

I Year II Semester

Code	Group	Subject	L	P	Credits
		Microcontroller & Applications	3	-	3
		Fuzzy Logic & Neural Networks	3	-	3
		MEMS	3	-	3
		Industrial Robotics	3	-	3
	Elective–III	Intelligent Manufacturing Systems Simulation, Modeling of Manufacturing Systems Design for Manufacture & Assembly	3	-	3
	Elective–IV	Autotronics & Vehicle Intelligence Computer Aided Metrology & Machine Vision Entrepreneurship	3	-	3
		Applied Mechatronics Lab: (Robotics, CNC, PLC etc)	-	3	2
		Seminar	-	-	2
		Total Credits	18	3	22

II Year - I Semester

Code	Group	Subject	L	P	Credits
		Comprehensive Viva	-	-	2
		Project Seminar	-	3	2
		Project work	-	-	18
		Total Credits	-	3	22

II Year - II Semester

Code	Group	Subject	L	P	Credits
		Project work and Seminar	-	-	22
		Total Credits	-	-	22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – II Sem. (Mechatronics)****APPLIED INDUSTRIAL PNEUMATICS****UNIT-I:**

Merits of Fluid power & its utility for increasing productivity through Low Cost Automation, Transmission of Fluid Power through various types of Cylinders), Symbolic representation of Pneumatic elements (CETOP), Compressors and Air supply system including airline installations, signaling & control system.

UNIT-II:

Pneumatic control elements (control valves & remote control system), Basic pneumatic circuits for controlling single & double acting cylinder, Basic pneumatic circuits, Advanced pneumatic circuits for controlling multi-cylinders (operable).

UNIT-III:

Advanced pneumatic circuits for controlling multi-cylinders (inoperable circuits), Electro pneumatics with relay logic, Pneumatics system with PID controls, Application of fluidics a non-moving part logic.

UNIT-IV:

Programmable sequential control using pneumatic modular elements, Stepper controls.

UNIT-V:

Programmable logic controllers-introduction, architecture hardware. Components-basics of PLC programming – Programming timers counters-master and jump controls- data manipulations and instructions.

REFERENCES:

1. Pneumatic Hand Book by Trade and technical press ltd.
2. Pneumatics Circuits and Low Cost Automation by Fawcett, Trade and technical press.
3. Pneumatic Systems by Majumdar.S.R, Tata Mc Graw-Hill.
4. Hydraulics & Pneumatics Power for Production by Stewart, Industrial press.
5. Fluid Power Logic Circuit Design by Peter Rohner, The Macmillan press 1979.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

APPLIED INDUSTRIAL HYDRAULICS

UNIT-I:

Introduction to Industrial Hydraulics, Hydraulics Power System elements and standard symbolic representation (CETOP symbols).

UNIT-II:

Various control valves used in Hydraulics System, Hydraulics accessories, Advantages of Hydro-Pneumatics and its applications, Different types of Hydraulics pumps and their applications, Hydraulics system and their classification.

UNIT-III:

Hydraulics circuits Hydraulic Motors, Hydraulic Fluids and effective contamination control

UNIT-IV:

Electro hydraulics system, Servo valves and proportional valves, Design of Cartridge Valves,

UNIT-V:

Hydraulics systems with PID controls Trouble shooting and remedial measures in Hydraulic system.

REFERENCES:

1. Hydraulic Hand Book by Trade and technical press Ltd.
2. Hydraulic Circuits by Fawcett, Trade and technical press.
3. Oil Hydraulic Systems by Majumdar. S. R, Tata Mc Graw-Hill
4. Fluid Mechanics and Hydraulics by Jagdish Lal, Metropolitan Book Company.
5. Hydraulic Systems Hand Book, Utility publications limited.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – I Sem. (Mechatronics)****AUTOMATION IN MANUFACTURING****UNIT-I:**

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, , Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT-II:

Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling, Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems, Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems.

UNIT -III:

Manual Assembly Lines, Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT-IV:

Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage , Analysis of Transfer lines with Storage Buffers.

UNIT-V:

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems- Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines ,Partial Automation.

TEXT BOOKS:

1. Automation, Production systems and computer integrated manufacturing/ Mikel P. Groover/ Pearson edu.,/2e.
2. CAD CAM : Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – I Sem. (Mechatronics)****INDUSTRIAL ELECTRICAL AND ELECTRONICS****UNIT-I:**

Basic Electrical Engineering, AC & DC Motor characteristics, Speed controls, Starting principles, Selection of proper motors for various applications.

Special Purpose Electrical Machines:- Induction generators self excitation requirements, steady state analysis, voltage regulation, different methods of voltage control, application to mini and micro hydel systems.

UNIT-II:

Doubly fed induction machines:- control via static converter, power flow, voltage/frequency control (generation mode), application to grid connected wind and mini/micro hydel systems.

Switched Reluctance Motor: Construction, operating performance, control and applications.

Brushless DC Machines: construction operation, performance, control and applications.

UNIT-III:

Linear Machines:- Linear Induction Machines and Linear Synchronous Machines. Construction, operation, performance, control and applications. Application of permanent magnets in electrical machine:- structure, magnetic materials used, types of motors e.g. PMDC and PM Synchronous Machine, control and applications. Recent developments in electrical machines.

UNIT-IV:

Basic Electronics, Diodes, Transistor configurations, SCR Controls, FET, UJT, A/D Conversion, D/A Conversion, Optoelectronic devices: photo diode/transistor, LDR, LED and LCD and PLASMA displays, opto-coupler, opto-interrupter, high speed detectors – PIN and avalanche photo diodes, DC Power Supplies, AC Power Supplies, Special operational amplifiers, Timing and counting circuits

UNIT-V:

Digital Control Theory :- Basic Digital concepts, Structure of a computer controlled system. Review of Z-transform. Computation of time response of Discrete Data system. Bilinear Transformation. W-plane, prewarping, inverse transformation. Design of discrete controllers. Z-domain compensation, w-plane compensation, state variable feed back, deadbeat controller sampled data version of PID controllers. Effect of Data Digitization. Effect of finite word size, limit cycle determination. Programmable logic devices: PLA, PLD, CPLD, FPGA and its application.

REFERENCE BOOKS:

1. Electrical Machines by P. S. Bimbra.
2. Power Plant Management by Z. Aghoni.
3. Power Electronics by P. S. Bimbra.
4. Low Power Electronics by Allen Helberg.
5. Micro Electronics by Sedra Smith.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (Mechatronics)
PRECISION ENGINEERING
(Elective – I)
UNIT I:

Concepts of Accuracy : Introduction – Concept of Accuracy of Machine Tools – Spindle ad Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags. Geometric Dimensioning and Tolerancing Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums – Datum Feature of Representation – Form Controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT II:

Datum Systems: Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT III:

Tolerance Analysis: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances.

Tolerance Charting Techniques - Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples. Design features to facilitate machining; Datum Features – functional and manufacturing. Components design – Machining considerations, Redesign for manufactured, Examples

UNIT IV

Surface finish, Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT V:

Fundamentals of Nanotechnology: System of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

Measuring Systems Processing : In processing or in-situ measurement of position of processing point- Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

TEXT BOOKS:

1. Precision Engineering in Manufacturing / murthy R. L., / New Age International(P) limited, 1996.
2. Geometric Dimensioning and Tolerancing / James D.Meadows / Marcel Dekker Inc.1995.

REFERENCE BOOKS:

1. Nano Technology / Norio Taniguchi / Oxford University Press, 1996.
2. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd, London.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – I Sem. (Mechatronics)****ADVANCED CNC TECHNOLOGY****(Elective- I)****UNIT I:**

Features of NC Machines : Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features on N/C Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT II:

NC part Programming: Manual programming-Basic concepts, Point to Point contour programming, canned cycles, parametric programming. Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

UNIT III:

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

UNIT IV:

Rapid Prototyping: Introduction, Stereo-lithography, Selective Laser Sintering, Fusion Deposition Modeling (FDM), LOM, Rapid Tooling.

UNIT V:

Post Processors for CNC: Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP-based-Post Processor: Communication channels and major variables in the DAPP-based Post Processor, the creative of a DAPP-Based Post Processor.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems / Yoram Korem / Mc Graw Hill Int. 1983.
2. Machine Tools Hand Book vol 3, (Automation & Control) / Manfred Weck / John Wiley and Sons, 1984.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

ELECTRO-OPTIC SYSTEMS

(Elective – I)

UNIT I:

Introduction : Electro-magnetic spectrum, Laws of blackbody radiation. Atmospheric propagation characteristics. detectors and optical materials. Aircraft applications of Electro-optic sensors and systems.

UNIT II:

Infrared Systems : Description, Analysis and design features of typical search and detection, imaging-tracking and homing systems.

UNIT III:

Laser Systems : Theory of laser operation –optical resonators-temporal and spatial coherence. Introduction to gas, solid and semiconductor lasers. Modular-electro-optic, Magneto-optic, Acoustics-optic, Q-switching, mode locking-cavity dumping. Introduction to gas, solid and semiconductor lasers. Introduction to holography and laser gyro. Description analysis and design features of lasers ranging designation and guidance systems. Laser hazards and safety measures.

UNIT IV:

Fiber-Optics : Types of Fiber optic cables and their characteristics, Fiber-optic elements, Applications in communication, networks and sensors, Fiber-optic gyroscopes.

UNIT V:

Imaging Devices and Tracking Systems : Forward and inverse iteration schemes- Graham Schmidt deflation- simultaneous iteration method- subspace iteration-Lanczo's algorithm-Estimation of core and time requirements.

TEXT BOOK:

1. liam L. Wolfe and George J. Zissis(ED), "Infrared Handbook", office of Naval Research, Dept. of the Naval Washington, DC, 1988.

REFERENCE BOOKS:

1. lectronics", Watson, J. Van Nostrand reinheld(UK) Co. Ltd., U.K.
2. Opto -Electronics for technology and Engineering" Robert G. Seippel, Prentice- Hall, New Jersey.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – I Sem. (Mechatronics)****CONTROL SYSTEMS****(Elective- II)****UNIT-I**

Mathematical Model For Physical Systems - Open loop – closed loop control – Differential equations of physical systems – Transfer functions – Block diagram algebra – Signal flow graphs - Reduction using Mason's gain formula.

Industrial Automatic Controls - Classification – Proportional derivative and integral control actions – Liquid level control systems with proportional and integral control – Pneumatic, hydraulic and electronic controllers

UNIT-II

Transient Response Analysis - Standard signals – transient response of first and second order systems – Steady state errors and error constants.

UNIT-III

Transfer Function Representation: Transfer function of DC servomotor – AC servomotor – Synchronous transmitter and receiver. Block diagram representation of systems – Representation by signal flow graph.

UNIT-IV

Stability Analysis: Concepts of Stability - Necessary conditions for stability – Hurwitz stability criterion – Routh's stability criterion – Relative stability. Frequency Response Analysis - The root locus concept – Frequency response, polar plot, Bode plot – Nyquist stability criterion.

UNIT-V

State Variable Model and Analysis - Concepts of state & state variables – Derivation of state models from Block diagrams - State space representation of systems – Transfer matrix - Solution of state equation – State transition matrix – Concepts of controllability and observability.

TEXT BOOKS

1. Control systems, Principles and Design / M Gopal / TMH.
2. Modern Control Engineering/ K.Ogata / Prentice Hall.
3. Control Systems /Anand Kumar / Prentice Hall.

REFERENCES:

1. Control Systems Engineering /Nagrath & M.Gopal/ Wiley Eastern.
2. Automatic control systems/ B.C.Kuo/John Wiley & Sons\ Modern Control Systems/ Richard C.Dorf and Robert H.Bishop.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

**INSTRUMENTATION & SENSOR TECHNOLOGY
(ELECTIVE-II)****UNIT-I**

Measurement and Characteristics: Elements of a Measurement System; Classification of Instruments; Static Performance Parameters; Loading and Impedance Matching; Errors and Uncertainties in Measurement; Process and Standards of Calibration; Dynamic Characteristics- Transfer Function Representation of a Measurement System, Impulse and Step Responses of First and Second Order Systems, Frequency Response of First and Second Order Systems.

UNIT-II

Mechanical Transducers: Temperature- Bimetallic Element and Fluid Expansion type Thermometers; Pressure- Manometers and Bourdon Gauges; Force- Balances, Helical Spiral Springs, Load Cells and Elastic Force Devices; Torque- Torsion Bars and Flat Spiral Springs; Liquid Level- Float Systems and Level to Pressure Converters; Flow- Pitot Static Tubes and Turbine type Flow Meters.

UNIT-III

Electrical Transducers: Resistance Thermometers; Interfacing Resistive Transducers to Electronic Circuits; Thermistors- Measurement of Temperature and Thermal Conductivity, Temperature Control; Resistance Strain Gauges- Gauge Factor, Bonded and Unbonded Strain Gauges; Self Generating and Non Self Generating Inductive Transducers; Linear Variable Differential Transformers; Capacitive Transducers - Potentiometric Transducers; Thermoelectric Transducers and Sources of Errors in Thermocouples; Piezoelectric and Magnetostrictive Transducers; Photoelectric Transducers- Photoemissive, Photoconductive and Photovoltaic types; Electromechanical Transducers- Tachometers, Digital Transducers-Electromagnetic Frequency Domain and Optoelectrical Frequency Domain Transducers, Vibrating String Transducers.

UNIT-IV

Basic Signal Conditioning Elements: Amplifiers- Non Electrical and Electrical types; Op Amps- Inverting, Non Inverting, Summing, Differential, and Charge Amplifiers; Differentiating and Integrating Elements; Filters; A to D and D to A Converters- Potentiometric, Dual Slope and Counting types; Data Transmission Elements- Electrical, Pneumatic, Position and Radio Frequency Transmission types; Compensation Elements for First and Second Order Systems - Basic Indicating, Recording, and Display Elements.

UNIT-V

Feedback in Instruments- Principles of Feedback and Advantages & Disadvantages of Feedback; Digital Voltmeters-Ramp and Dual Slope types; Servo type Potentiometric and Magnetic Tape Recorders; Digital Recorders of Memory type; Data Displays-Analog and Digital types. Advanced Measuring Techniques: Temperature- Total and Selective Radiation type Pyrometers; Pressure- McLeod Gauge, Ionization Gauge; Flow- Ultrasonic and Electromagnetic Flow Meters, Hot Wire Anemometer.

UNIT-VI

Proximity Sensors- Reed Sensors, Inductive proximity sensor, Capacitive proximity sensor, Optical sensor with through beam, Retro Reflective, Diffuse sensors, Analog inductive, Analog capacitive, Analog optical, Ultrasonic sensors.

TEXT BOOKS

1. Electronic Measurements and Instrumentation, K. Lal Kishore, Pearson Education Publications.
2. Electronic Instrumentation, H.S. Kalsi-TMH Publications.

REFERENCE BOOKS:

1. Albert D Helfrick and William D Cooper; Modern Electronic Instrumentation and Measurement Techniques; 2004, PHI.
2. BC Nakra, and Chaudhry; Instrumentation, Measurement and Analysis; 2004, Tata McGraw-Hill.
3. DVS Murthy; Transducers and Instrumentation; 2003, PHI.
4. CS Rangan, GR Sarma, and VSV Mani; Instrumentation Devices and Systems; Tata McGraw-Hill.
5. Doebelin and Ernest; Measurement Systems Application and Design; 2004, Tata McGraw-Hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

**POWER ELECTRONICS & DRIVES
(ELECTIVE-II)****UNIT-I**

Introduction : Introduction to Power electronics- Power electronics versus linear electronics- Review of thyristors- Power FETS – Turn on and off circuits- Microprocessor based firing circuits- Series and Parallel operation –protection circuits- Design of snubber circuits- rating and protection.

UNIT-II

Converters and Inverters: Analysis of half controlled and fully controlled converters- Dual converters- Analysis of voltage source and current source- Current source and series converters.

UNIT-III

Industrial Motor Control : Methods of controlling speed – Introduction and DC Motor controls- use of Microcontroller for speed control- Feedback and Feed forward control- Step-Up and Step- Down Choppers- use of Choppers- Frequency converters and cyclo converters.

UNIT-IV

Relays, Heat and Welding : Standard Eigen value problems- properties of Eigen values and Eigen Vectors- Generalized Eigen value problems- Strum sequence- Jacobi, Givens and Householders transformations.

UNIT-V

Process Controllers : Elements of process control- Process Characteristics- ON?OFF control- Proportional and Derivative control- electronic controllers – Pneumatic controller- Temperature, flow and pressure control- voltage regulations- principle of digital control.

TEXT BOOK:

1. R.Ralph Benediet and Nathan Weiner- "Industrial electronics circuits and applications" – prentice hall of India New Delhi, 1996.

REFERENCE BOOKS:

1. P.C Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons Inc 2nd edition, 1997.
2. Harrott. P " Process Control"- Tata McGraw Hill 1991.
3. Joseph Vithayathil, "Power Electronics": Principle and Application McGraw Hill 1st edition 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – I Sem. (Mechatronics)****CONTROL LAB****(PNEUMATIC, HYDRAULICS, ELECTRICAL & ELECTRONICS CONTROL)****LIST OF EXPERIMENTS****Any TEN of the following Experiments**

1. Study of Pneumatic, Electro-Pneumatic control Valves and various components.
2. Study of Hydraulic, Electro-Hydraulic Control Valves and various components.
3. Draw the Circuit diagram to operate Double Acting Hydraulic Cylinder using 4/2 Direction Control Valve (Manual type).
4. Draw the Circuit diagram to operate Double Acting Hydraulic Cylinder using 4/2 Direction Control Valve (Solenoid Control) using Push Button Switch / Latch Switch.
5. Draw the Circuit diagram to operate Double Acting Hydraulic Cylinder using 4/2 Direction Control Valve (Solenoid Control) using Push Button Switch / Latch for varying flow rate using variable throttle valve.
6. Draw the Circuit diagram to operate Single Acting Pneumatic Cylinder using 3/2 Push Button Direction Control Valve.
7. Draw the Circuit diagram to operate Double Acting Pneumatic Cylinder using 5/2 Direction Control Valve using Push Button Momentary Switch / Push Button Latch.
8. Simulation of working of Double Acting Hydraulic Cylinder using various Direction Control Valves with H Simulator.
9. Simulation of Double Acting Hydraulic Cylinder using 4/2 Direction Control Valve (Manual type) using Automation Studio.
10. Simulation of Single Acting / Double Acting Pneumatic Cylinder using 3/2 Push Button Direction Control Valve using P- Simulator.
11. Draw the Circuit diagram to operate Double Acting Hydraulic Cylinder using 4/2 Direction Control Valve (Solenoid Control) using PLC.
12. Draw the Circuit diagram to operate Double Acting Hydraulic Cylinder using 4/3 Direction Control Valve (Solenoid Control) using PLC.
13. Draw the Circuit diagram to operate a Single Acting Pneumatic Cylinder using 5/2 Air Spring Valve and PLC.
14. Draw the Circuit diagram to operate a Double Acting Pneumatic Cylinder using 5/2 Air Spring Valve and PLC.

LIST OF EQUIPMENTS

1. Hydraulic Trainer Kit (Manual Control) – 1 No. Consisting of
 - i) Hydraulic Power Pack.
 - ii) Double Acting Hydraulic Cylinder.
 - iii) 4/2 directional Control Valve.
 - iv) 4/3 Direction Control Valve.
 - v) Variable Flow Control Valve.
 - vi) Pressure Gauges.

2. Electro-Hydraulic Trainer Kits – 2 No.'s consisting of
 - i) Hydraulic Power Pack.
 - ii) Double Acting Hydraulic Cylinder.
 - iii) 4/2 directional Control Valve (Single Solenoid-Spring Return).
 - iv) 4/2 directional Control Valve (Solenoid Control).
 - v) 4/3 direction Control Valve (Solenoid Control).
 - vi) Accumulator.
 - vii) Variable Flow Control Valve.
 - viii) Pressure Gauges.
 - ix) Proximity Sensors.
 - x) PLC ABB make (12 inputs – 8 outputs)
 - xi) PLC – KEYENCE make (6 inputs 4 outputs)
 - xii) Electrical Controls – Push Button Momentary Switch and Latch Switch.
3. Pneumatic Trainer Kit (Manual Control)- 1 No. consisting of
 - i) Air Compressor.
 - ii) FRL Unit.
 - iii) Single Acting Pneumatic Cylinder.
 - iv) Double Acting Pneumatic Cylinder.
 - v) 3/2 Push Button Directional Control Valve.
 - vi) 5/2 Directional Control Valve (Manual Control).
 - vii) 5/2 Directional Control Valve (Single Pilot & Spring Return).
 - viii) 5/2 Directional Control Valve (Double Pilot).
4. Electro-Pneumatic Trainer Kits – 2 no.'s consisting of
 - i) Air Compressor.
 - ii) FRL Unit.
 - iii) Single Acting Pneumatic Cylinder.
 - iv) Double Acting Pneumatic Cylinder.
 - v) 5/2 directional Control Valve (Solenoid Control).
 - vi) 5/2 Directional Control Valve (Single Solenoid).
 - vii) Variable Flow Control Valve.
 - viii) Pressure Gauges.
 - ix) Proximity Sensors.
 - x) PLC ABB make (12 inputs – 8 outputs)
 - xi) PLC – KEYENCE make (6 inputs 4 outputs)
 - xii) Electrical Controls – Push Button Momentary Switch and Latch Switch.
5. Simulation Software
 - i) Automation Studio.
 - ii) H-Simulator.
 - iii) P- Simulator.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – II Sem. (Mechatronics)****MICRO CONTROLLERS & APPLICATIONS****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 stepper 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.

TEXT 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.

REFERENCE BOOKS:

1. Myke Predko “ Programming & Customizing the 8051”, Tata McGraw Hill, 1999.
2. Raj Kamal “Embedded systems, Architecture, Programming and Design, “Tata McGraw Hill, 2003.
3. Kenneth J. Ayala, The 8051 Microcontroler, CENGAGE Publisher.
4. Fernando E. Valdes-Perez and Ramon Pallas-Areny, Microcontrollers-Fundamentals and Applications with PIC, CRC Press.
5. KVK Prasad, Embadded Real Time Systems, DearmTech Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – II Sem. (Mechatronics)****FUZZY LOGIC & NEURAL NETWORKS****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 –Defuzzification- Knowledge base- Decision making logic- Membership functions – Rule base.

UNIT-II

Adaptive Fuzzy Systems: Performance index- Modification of rule base- 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. Neural Networks for control, Millon W.T, Sutton R.S and Werbos P.J, MIT Press 1992.
2. Fuzzy sets Fuzzy logic, Klir, G.J and Yuan B.B Prentice Hall of India Pvt. Ltd., New Delhi.
3. Neural Networks and Fuzzy systems, Kosko.. Prentice hall of India Pvt. Ltd., New Delhi 1994.
4. Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996.
5. Introduction to Artificial Neural systems, Zurada J.M Jaico Publishing House, New Delhi 1994.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

M E M S

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 Continuum 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.

TEXT BOOK:

1. Tia-Ran Hsu, MEMS & Microsystems. Design & Manufacturing, TMH 2002.

REFERENCES:

1. Maluf, M., "An Introduction to Microelectromechanical Systems Engineering". Artech House, Boston 2000.
2. Trimmer , W.S.N., "Micro robots and Micromechnaical Systems", Sensors & Actuators, Vol 19, 1989.
3. Trim., D.W., "Applied Partial Differential Equations"., PWS-Kent Publishing, Boston, 1990.
4. Stephen D. Senturia, Microsystem Design, Springer Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

INDUSTRIAL ROBOTICS

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 Desgin 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.

TEXT 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.

REFERENCE BOOKS:

1. Robotics / K.S.Fu / McGraw Hill.

2. Robot Analysis/Lung Wen Tsai/John Wiley & Sons.
3. Robotics & control/RK Mittal & IJ Nagrath/ Tata McGrawHill.
4. Fundamentals of Robotics/Robert J.schilling/PHI.
5. Robotics by saha/TMG.
6. Robotic Engineering/ Richard D.Klafter, Thomas A.Chmielewski/PHI.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – II Sem. (Mechatronics)****INTELLIGENT MANUFACTURING SYSTEMS****(Elective – III)****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, Inference 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 Base, Knowledge Base, Clustering Algorithm.

TEXT BOOKS:

1. Intelligent Manufacturing Systems / Andre Kusaic.
2. Artificial Neural Networks / Yagna Narayana.
3. Automation, Production Systems and CIM / Groover M.P. Neural Networks / Wasserman.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

SIMULATION, MODELING OF MANUFACTURING SYSTEMS

(Elective-III)

UNIT I:

System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1 & 2 errors – Framing – strong law of large numbers.

UNIT II:

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

UNIT III:

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoulli – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT – Simulation of M/M/1 queue – comparison of simulation languages.

UNIT IV:

Output data analysis – Types of Simulation w.r.t output data analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

UNIT V :

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

TEXT BOOKS:

1. Simulation Modelling and Analysis / Law, A.M. & Kelton / McGraw Hill, 2nd Edition, New York, 1991.
2. Discrete Event System Simulation / Banks J. & Carson J.S., PH / Englewood Cliffs, NJ, 1984.
3. Simulation of Manufacturing Systems / Carrie A. / Wiley, NY, 1990.
4. A Course in Simulation / Ross, S.M., McMillan, NY, 1990.
5. Simulation Modelling and SIMNET / Taha H.A. / PH, Englewood Cliffs, NJ, 1987.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – II Sem. (Mechatronics)
DESIGN FOR MANUFACTURE & ASSEMBLY
(Elective-III)
UNIT I:

Introduction : Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing 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 – 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 die forging design – Location of parting lines of dies – Drop forging die design – General design recommendations

UNIT IV:

Extrusion, Sheet Metal Work & Plastics: Design guidelines for Extruded sections - Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

PLASTICS: Viscoelastic and Creep behavior in plastics – Design guidelines for Plastic components – Design considerations for Injection Moulding .

UNIT V:

Design for Assembly : General design guidelines for Manual Assembly- Development of 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- Effect of symmetry , Further design guidelines.

TEXT BOOKS:

1. Engineering design-Material & Processing Approach/ George E. Deiter, Mc. Graw Hill Intl. 2nd Ed.2000.
2. Product design for Manufacture and Assembly/ Geoffrey Boothroyd/Marcel Dekker Inc. NY, 1994.

REFERENCE BOOKS:

1. Product design and Manufacturing / A.K Chitale and R.C Gupta / Prentice – Hall of India, New Delhi, 2003.
2. Design and Manufacturing / Surender Kumar & Goutham Sutradhar / Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.
3. ASM Handbook, Vol.20.
4. Hand Book of Product Design/ Geoffrey Boothroyd Marcel Dekken Inc. NY, 1990.
5. Product Design/ Kevin Otto and Kristin Wood/ Pearson Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

AUTOTRONICS & VEHICLE INTELLIGENCE**(Elective-IV)****UNIT-I**

Automotive fundamentals : The engine-components-Drive train- starting & charging systems operation – Ignition system- Suspension systems- brakes- ABS- Steering systems.

UNIT-II

Automotive Sensors : Temperature sensor- Gas sensor- Knock sensor- Pressure sensor- Flow sensor- Torque sensor- Crash sensor-Speed sensor and Acceleration sensor-Micro sensor- Smart sensor- Operation, types, Characteristics, advantage and their applications.

UNIT-III

Fuel Injection and Ignition System : Introduction- fuel system components- Electronic fuel system-Fuel injection-types-throttle body versus port injection-Electronic control fuel injection- operation –different types- Fuel injectors- idle speed control- Continuous injection system- High pressure diesel fuel injection-MPFI system- Electronic ignition system- operation – types- Electronic spark timing control.

UNIT-IV

Electrical Vehicles and Hybrid Vehicles : Introduction-Electric Vehicle development- system layout-basic system components- Electric battery- solar cells- Rapid charging system-Motor drive system-fuel cell Electric vehicle- Hybrid vehicle- Series Hybrid Vehicle- Parallel Hybrid Vehicle-CNG Electric hybrid vehicle.

UNIT-V

Vehicle Intelligence : Introduction – Base structure- Vision based autonomous road vehicles- Architecture for dynamics vision system-Features- applications –A visual control system using image processing and fuzzy theory- An application of mobile robot vision to a vehicle information system- Objective detection, collision warning and avoidance system-Low tyre pressure warning systems.

TEXT BOOK:

1. Understanding Automotive Electronics, William B. Ribben, 6th edition Elsevier Science-2003.

REFERENCES:

1. Sensor and Transducers, Ronald K. Jurgen, SAE-2003
2. Automotive Technology", Jack Erjavec, Robert Scharff, -Delmar Publications Inc 1992.
3. Electric and Hybrid-electric vehicles, Ronald K. Jurgen, SAE 2002.
4. Vision-based Vehicle Guidance, Ichiro Masaki, -Springer verlag, New York 1992.
5. Class Room Manual for Automotive Service and System, Jay Webster, -Delmer Publications Inc 1995.
6. Light Weight electric/Hybrid Vehicle Design, Ron Hodkinson, John Fenton.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

COMPUTER AIDED METROLOGY & MACHINE VISION

(Elective-IV)

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.

TEXT BOOK:

1. Computers as Components, Principles of Embedded Computers Systems Design, Wayne Wolf Morgan.

REFERENCE BOOKS:

1. J. Watson, Opto- electronics, Van Nostrand, Reinhold (UK) Co.Ltd, 1988.
2. Taguchi. G.L Syed et al. Quality Engineering in product Systems, McGraw Hill, 1980.
3. John bank, : Essence of TQM, Prentice Hall of India Pvt, 1990.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

ENTREPRENEURSHIP

(Elective-IV)

UNIT-I

Nature of Entrepreneurship; Essential features, attitude and leadership of entrepreneur Characteristics, Qualities and skills, functions of entrepreneur, Entrepreneur scenario in India and Abroad. Forms of Entrepreneurship: Small Business, Importance in Indian Economy, Types of ownership, sole trading, partnership, joint stock company, Important features of Various types of businesses, corporate entrepreneurship, intrapreneurship, Role of Government in the promotion of Entrepreneur, State Enterprises in India.

UNIT-II

Aspects of Promotion: Opportunity Analysis, SWOT Analysis, Internal and External Environment Analysis, Technological Competitiveness, Entrepreneurs and legal regulatory systems, patents and trademarks, Intellectual Property Rights- Project Planning and Feasibility Studies: The Concept of Project, Project Life Cycle, Project Planning, Feasibility, SWOT Analysis, Product and Process Development, Major steps in product development.

UNIT-III

Financial Aspects of the Entrepreneurship: Source of Capital, Debt-Equity Financing Commercial Banks, Bank Loans, Assessment of Benefits and Costs, Informal Agencies In financing entrepreneurs, Government Grants and Subsidies, Types of Investors and Private Offerings.

UNIT-IV

Entrepreneurial Strategy: Generation of new entry opportunity, Decisions under Uncertainty, entry strategy, new entry exploitation, environmental instability and First-Mover disadvantages, Risk Reduction strategies, Market scope strategy, Imitation strategies and Managing Newness.

UNIT-V

Women Entrepreneurship: Introduction, The dynamic need, entrepreneurship in a Developing economy, the scope of entrepreneurship among women, promotional efforts supporting women entrepreneurs in India, Issues of employment generation- Rural Entrepreneurship and EDPs: Need, Rural Industrialisation, NGO's and Rural Entrepreneurship, Need for EDP,s, Objectives of EDPs, course contents and curriculum of EDPs, Phases of EDPs, & Evaluation of EDPs

REFERENCES:

1. Madhurima Lall, Shikha Sahai, entrepreneurship, Excel Books, First Edition, New Delhi, 2006.
2. H. Nandan, Fundamentals of Entrepreneurship, PHI, New Delhi, 2009.
3. Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, New Delhi, 2009.
4. Rashmi Bansal, Stay Hungry, Stay Fun, Oxford, 2008.
5. Alfred E. Osborne, Entrepreneur's Toolkit, Harvard Business Essentials, HBS Press, USA, 2005.
6. S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2009.
7. Thomas W. Zimmerer, Norman M. Scarborough, Essentials of Entrepreneurship And Small Business Management, Pearson, New Delhi, 2006.
8. S.R. Bhowmik, M. Bhowmik, Entrepreneurship-A tool for Economic Growth And A key to Business Success, New Age International, New Delhi, 2007.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M. Tech – I Year – II Sem. (Mechatronics)****APPLIED MECHATRONICS LAB
(ROBOTICS, CNC, PLC ETC)****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. Designing of ladder logic for various practical applications.
14. Execution of ladder logic using PLC's.

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 Fanuc ROBOT with Teach Pendant along with accessories like PCB Rack, Controller, Automatic Tool Changer, Assembly Rack, Assembly unit.
4. Edge Cam Software for turning and milling modules.
5. Programmable Logic Controllers with software.