ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M. Tech.
ADVANCED MANUFACTURING SYSTEMS

(Applicable for the batches admitted from 2011-2012)

VNR VIGNANA JYOTHI
INSTITUTE OF ENGINEERING & TECHNOLOGY
(AFFILIATED TO JNTUH)
An Autonomous Institute under JNTUH

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Academic Regulations 2011 For M.Tech. Degree Course
(Effective for the students admitted into first year from the academic year 2011-2012)

1. Introduction

Academic Programmes of the institute are governed by rules and regulations as approved by the academic council of the institute.

These academic rules and regulations are effective from the academic year 2011-12, for the students admitted into two year post graduate programme offered by the college leading to Master Of Technology (M. Tech.) degree in the disciplines viz., Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics and Communication Engineering, Computer science and Engineering, Information Technology, Electronics and Instrumentation Engineering and Automobile Engineering.

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

1.1 Eligibility for Admissions

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by the University from time to time. Admissions shall be made on the basis of GATE Rank and merit rank obtained by the qualifying candidate at an Entrance Test conducted by the University, subject to reservations prescribed by the university/ State Government from time to time.

2. Courses of Study

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

1. Advanced Manufacturing Systems
2. Highway Engineering
3. Structural Engineering
4. Power Electronics
5. Software Engineering
6. VLSI System Design
7. Embedded Systems
8. Geotechnical Engineering
9. Electronic Instrumentation
10. Automation

and any other course as approved by the Academic Council of the Institute and the authorities of the University from time to time.

2.1 Departments offering M.Tech. Programmes with specializations are mentioned below:

ME	1.Advanced Manufacturing Systems 2. Automation
CE	1. Highway Engineering 2.Structural Engineering 3 Geotechnical Engineering
EEE	Power Electronics
CSE	Software Engineering
ECE	1.VLSI System Design 2.Embedded Systems
EIE	Electronic Instrumentation

3. Attendance

Each academic year shall be divided into two semesters, each of 90 Instructions days, excluding examination, evaluation, declaration of results etc.

3.1 A candidate shall be deemed to have eligibility to write end semester examinations in a subject if he has put in at least 75% of attendance in that subject.

3.2 Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by the College Academic Committee on genuine and valid reasons on application by the candidate with supporting evidence.

3.3 A candidate shall get 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.

3.4 Shortage of attendance below 65% shall in no case be condoned.

3.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

3.6 In case the candidate secures less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). He shall re-register the subject when next offered.

4. 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.

4.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination, 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the better 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 duration of 2 Hours with 4 questions to be answered out of 6 questions.

4.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations, 40 marks shall be awarded based on the day-to-day performance as Internal Marks.

4.3 There shall be two seminar presentations during the I year, one in each 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 Committee. The Departmental Committee consists 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% to be declared successful.

4.4 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 aimed to assess the students' understanding in various subjects studied during the M.Tech. course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-Voce.

4.5 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 Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

4.6 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 he has failed in the end examination. In such a case candidate may re-register for the subject(s) and secure required minimum attendance. Attendance in the re-registered subject(s) has to be calculated separately to become eligible to write the end examination in the re-registered subject(s). Re-registration for the subjects is allowed only if that particular re-registration subjects are the hindrance for the award of Degree. Re-registration is allowed in this case provided the student doesn't have any subject(s) yet to pass other than the re-registration subjects with prior permission.

4.7 Laboratory examination for M.Tech. courses must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner shall be a teacher of same specialization either external or from the same dept.

5. Evaluation of Project / Dissertation Work.

5.1 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

5.2 A Project Review Committee (PRC) shall be constituted with at least four members namely HOD, PG Coordinator of the Department, project supervisor and one senior faculty member of same specialization.

5.3 After satisfying 5.1, a candidate has to submit, in consultation with the project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for its approval. Only after obtaining the approval of Departmental Academic Committee, the student can initiate the Project work.

5.4 If a candidate wishes to change his supervisor or topic of the project he can do so with the approval of Departmental Academic Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

5.5 Internal Evaluation of the project shall be on the basis of the seminars(Project reviews) conducted during the II year by the committee consisting of Head of the Department, project supervisor ,PG coordinator of the Department and senior faculty member of the Department. belonging to same specialization. A candidate shall submit status report in a spiral bound copy form.

5.6 The work on the project shall be initiated in the beginning of the second year and the duration of project is for 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 240 days from the date of registration of the project work. For the approval of PRC the candidate shall submit the daft copy of thesis to the Head of the Department (Through project supervisor/PG coordinator) and shall make an oral presentation before the PRC.

5.7 After approval of PRC, every student has to submit three copies of the Project Thesis certified by the supervisor to the Department.

5.8 The thesis shall be adjudicated by one examiner selected by the Chief Superintendent. For this, HOD shall submit a panel of 3/ 5 examiners, who are eminent in that field with the help of the concerned guide.

5.9 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, within the time frame as described by PRC. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

5.10 If the report of the examiner is favorable, 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 candidates work as:

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

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination. The candidate has to secure any one of the grades as Excellent, Good or Satisfactory on his thesis/dissertation and viva-voce. If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination, he has to reregister the project work as in clause 5.1. However, the candidate may select a new guide and new topic with the approval of the PRC and submit the project report with a minimum of 240 days from the date of re-registration. Of course this shall not prejudice the clause 6.1 below. The candidate can be permitted to change the topic/guide only once.

6. Award of Degree and Class

A student shall be declared eligible for the award of the M.Tech. degree, if he pursues a course of study and completes it successfully for not less than two academic years and not more than four academic years.

6.1 A student, who fails to fulfil all the academic requirements for the award of the degree within four academic years from the year of his admission, for any reason whatsoever, shall forfeit his seat in M.Tech. Course.

6.2 After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree 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%

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

7. Withholding of Results

If the candidate has not paid any dues to the Institute or if any case of indiscipline is pending against him, the result of the candidate will be withheld and he will not be allowed into the next higher semester. The issue of the degree is liable to be withheld in such cases. This delay shall not prejudice clauses Nos.6.0 and 6.1

8. Transitory Regulations

Candidate who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered without precluding clauses Nos.6.0 and 6.1

9. General

9.1 The academic regulations should be read as a whole for purpose of any interpretation.

9.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

9.3 The Institute may change or amend the academic regulations and syllabi at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the Institute.

9.4 Wherever the words he, him or his occur, they will also include she, her and hers.

10. Supplementary Examination

Supplementary examinations will be conducted along with regular semester end examinations. Supplementary examinations will be conducted to a maximum number of four continuous times subsequent to the revision of the syllabus. Supplementary examinations will be conducted in the equivalent courses as approved by the Institute Academic Committee.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY, HYDERABAD

M. Tech. (ADVANCED MANUFACTURING SYSTEMS)

I YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	P	Credit
R11AMS2101		Automation in manufacturing	3	0	3
R11AMS2102		Materials Technology	3	0	3
R11AMS2103		Precision Engineering	3	0	3
R11AMS2104		Design for Manufacturing & Assembly	3	0	3
R11AMS2105	**Elective - I**	Special Manufacturing Processes	3	0	3
R11AMS2106		Product Data Management			
R11AMS2107		Total Quality Management			
R11AMS2108	**Elective - II**	Advanced CAD	3	0	3
R11AMS2109		Mechatronics			
R11AMS2110		Theory of Elasticity & Plasticity			
R11AMS2201	**Lab**	Manufacturing Simulation & Precision Engineering lab	0	3	2
R11AMS2301		Seminar	0	0	2
		Total Credits (6 Theory + 1 Lab.)	**18**	**3**	**22**

I YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	P	Credit
R11AMS2111		Simulation Modeling of Manufacturing Systems	3	0	3
R11AMS2112		Quality Engineering in Manufacturing	3	0	3
R11AMS2113		Computer Aided Manufacturing	3	0	3
R11AMS2114		Production and Operations Management	3	0	3
R11AMS2115	**Elective - III**	Industrial Robotics	3	0	3
R11AMS2116		Tool Design			
R11AMS2117		Design and Manufacturing of MEMS and Micro Systems			
R11AMS2118	**Elective - IV**	Performance Modeling and Analysis of Manufacturing Systems	3	0	3
R11AMS2119		Computational Fluid Dynamics			
R11AMS2120		Intelligent Manufacturing Systems			
R11AMS2202	**Lab**	CAD/CAM Lab	0	3	2
R11AMS2301		Seminar	0	0	2
		Total Credits (6 Theory + 1 Lab.)	**18**	**3**	**22**

* L/P: Lectures/Practical

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M. Tech. (ADVANCED MANUFACTURING SYSTEMS)

II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	P	Credit
R11AMS2302		Comprehensive Viva	0	0	2
R11AMS2303		Project Seminar - I	0	3	2
R11AMS2304		Project Work	0	0	18
		Total Credits	**0**	**0**	**22**

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Group	Subject Name	L	P	Credit
R11AMS2305		Project Work	0	0	20
R11AMS2306		Project Seminar – II	0	0	2
		Total Credits	**0**	**0**	**22**

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2101) AUTOMATION IN MANUFACTURING

UNIT I:

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation, Automation - reasons, Production operations and automation strategies-Plant Layout, production concepts and mathematical models -design the parts for automation, Automatic loading Systems.

UNIT II:

High Volume Production Systems: Automated flow lines, Methods of work flow - transport transfer mechanisms, buffer storage, Control functions, Automation for machining operations, Design and fabrication considerations.

UNIT III:

Analysis of Automated Flow Lines: Analysis of transfer lines without storage -partial automation automated flow lines with storage buffers implementing of automatic flow lines. Line balancing problems, Considerations in assemble line design.

UNIT IV:

Assembly Systems and Line Balance; Manual assembly lines - line balancing problem - methods of line balancing - ways to improve line balancing - flexible manual assembly lines - automated assembly systems, Analysis of multi station assembly. Manufacturing Cells, Automated Cells, Analysis of Single Station Cells

UNIT V:

Automated Material Handling: Types of equipment and functions, design and analysis of material handling system, conveyor system. Automated guided vehicle system, components operation, types, design of automated guided vehicles and applications. Automated storage and Retrieval systems - types, basic components and applications. Transfer lines, Design for Automated Assembly, Partial Automation, Communication Systems in Manufacturing

Text Books:

(1) Mikell P. Grower, "Automation, Production Systems and CIM", PHI Pvt, Ltd,, 1998
(2) P. Radha Krishnan **&** S. Subrahamanyarn and Raju, "CAD/CAM/CIM", New Age International Publishers, 2003
(3) Singh,"Svstem Approach to Computer Integrated Design and Manufacturing", John Wiley 1996.

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2102) MATERIALS TECHNOLOGY

UNIT I:

Elasticity in metals and polymers, mechanism of plastic deformation , Role of dislocations, Yield stress, Shear strength of perfect and real crystals, Strengthening mechanism, Work hardening, Solid solution, Grain boundary strengthening, Poly phase mixture, Precipitation, Particle Fiber and dispersion strengthening; Effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material

UNIT II:

Griffith's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson - Miller parameter, Deformation and Fracture mechanism maps.

UNIT III:

Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Pari's Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

UNIT IV:

Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep. Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, Auto, Marine, Machinery and Nuclear Applications.

UNIT V:

Modern Metallic Materials: Dual Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel Transformation induced plasticity (TRIP) Steel, Maraging Steel, Intermetallics, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass Quasi Crystal and Nano Crystalline Materials.

Nonmetallic Materials: Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesive and Coatings, structure, Properties and Applications of Engineering, polymers, Advanced Structural Ceramics WC, TiC, TiG, A 12 O3, SiC, Si3 N4, CBN and Diamond - properties, Processing and applications.

Text Books:

1. Mechanical Behavior of Materials/Thomas H. Courtney/ 2nd Edition, McGraw Hill, 2000
2. Mechanical Metallurgy/George E. Dicter/McGraw Hill, 1998.

Reference:

1. "Selection and use of Engineering Materials", 3e/Charles J.A/Butterworth Heiremann.

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2103) PRECISION ENGINEERING

UNIT I:

Concepts of Accuracy: Introduction - Concept of Accuracy of Machine Tools - Spindle and Displacement Accuracies - Accuracy of Numerical Control Systems - Errors due to Numerical Interpolation, Displacement Measurement System and Velocity tags

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 Tolerancing.

UNIT II:

Datum Systems: Design of freedom, Grouped Datum System - 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. 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 IV:

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 V:

Fundamentals of Nanotechnology: Systems 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

References:

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

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2104) DESIGN FOR MANUFACTURING AND ASSEMBLY

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 - 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 die forging design - Parting lines of die 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:

Assembly Advantages: Development of the assembly process - Choice of assembly method - Assembly 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.

Text Books:

1. Geoffrey Boothroyd, “Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.
2. Engineering Design – Material & Processing Approach – George E. Dieter, McGraw Hill Intl. 2nd Ed. 2000.

Reference Books:

1. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekker, N.Y. 1990.
2. A. Delchambre "Computer Aided Assembly Planning”, Springer London, 1992.

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	L	P	C
I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)			
Elective – I	**3**	**0**	**3**

(R11AMS2105) SPECIAL MANUFACTURING PROCESS

UNIT I:

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT II:

Processing of ceramics: Applications, characteristics, classification, Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT III:

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in micro electronics, surface mount technology, Integrated circuit economics.

UNIT IV:

E-Manufacturing, nanotechnology. and micromachining, High Speed Machining.

UNIT V:

Rapid Prototyping: Working Principles, Methods, Stereo-Lithography, Laser Smiting, Fused Deposition Method, Applications and Limitations

TEXT BOOKS:

1. Manufacturing Engineering and Technology, I Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.
3. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,
4. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
5. Advanced Machining Processes / V.K.Jain / Allied Publications.
6. Introduction to Manufacturing Processes / John A Schey / Mc Graw Hill.

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	L	P	C
I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)			
Elective – I	**3**	**0**	**3**

(R11AMS2106) PRODUCT DATA MANAGEMENT

UNIT I:

Introduction: Need for IPPD – Strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and Customer – Behavior analysis. Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – Process management and improvement – Plan and establish product specification.

UNIT II:

Concept generation and Selection: Task - Structured approaches – Clarification - Search - Extemally and internally - Explore systematically – reflect on the solutions and process – concept selection – methodology – benefits

Product Architecture: Implications - Product change - variety – component standardization - product performance - manufacturability.

UNIT III:

Product Development Management: Establishing the architecture - creation - clustering-geometric layout development - fundamental and incidental interactions - related system level design issues - secondary systems- architecture of the chunks ~ creating detailed interface specifications.

Industrial design: Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools - simulating product performance and manufacturing 'processing electronically - Need for industrial design - impact - design process.

UNIT IV:

Investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

UNIT V:

Design for Manufacturing and Product Development: Definition - Estimation of manufacturing cost - reducing the component/costs and assembly costs- Minimize system complexity. Prototype basics - Principles of Rapid prototyping - planning for prototypes – Economic analysis - Understanding and representing tasks - baseline project planning - accelerating the project execution.

Text Books:

1. Product Design and Development / Kari T. Ulrich and Steven D.Eppinger / McGraw Mill International Edns. 1999.
2. Concurrent Engg/integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(3 10)377-569, Workshop Book.
3. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.
4. Tool Design - Integrated Methods for Successful Product Engineering / Staurt Pugh / Addsion Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-4 1369-5.

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective – I	**3**	**0**	**3**

(R11AMS2107) TOTAL QUALITY MANAGEMENT

UNIT I:

Introduction: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs., Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT II:

Customer Focus and Satisfaction: Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer- Supplier relationships. Bench Marketing: Evolution of Bench Marketing; meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls' of bench marketing.

UNIT III:

Organizing for TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles, Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT IV:

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT V:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-90, Series Standards/ benefits ISO 9000 certification, the third party audit, Documentation ISO 9000 and services, the cost of certification implementing the system.

References:

1 . "Total Quality Management" by Joel E.Ross.
2. "Beyond TQM" by Robert LJFlood.
3 . "Statistical Quality Control" by E.L.Grant.

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	L	P	C
I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)			
Elective – II	**3**	**0**	**3**

(R11AMS2108) ADVANCED CAD

UNIT I :
CAD Tools : Definition of CAD Tools, CAD/CAM system evaluation criteria, Brief treatment of input and output devices, Graphics standard, Functional areas of CAD, Modeling and Viewing, Software documentation, Efficient use of CAD software.

UNIT II :
Geometric Modelling – 2D : Types of mathematical representation of curves, Wire frame models, Wire frame entities, Parametric representation of synthetic curves, Hermite Cubic Splines, Bezier curves, B-Splines.

UNIT III:
Surface Modeling : Mathematical representation surfaces, Surface model, Surface entities, Surface representation, Parametric representation of surfaces, Plane surface, Ruled surface, Surface of revolution, Tabulated Cylinder.

UNIT IV :
Parametric Representation of Synthetic Surfaces : Hermite Bi-cubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface, Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, 2-D & 3-D Transformations: Translation, Rotation, Scaling, Reflection, Shear.

UNIT V:
Geometric modelling - 3D : Solid modeling, Solid Representation, Boundary Representation (B-Rep), Constructive Solid Geometry (CSG).
CAD/CAM Exchange : Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation.
Applications : Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

Text Books:
1. CAD/CAM Theory and Practice / Ibrahim Zeid / McGraw Hill international.

References:
1. Mastering CAD-CAM / Ibrahim Zeid / McGraw Hill international.
2. CAD/CAM / P.N.Rao / TMH.

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	L	P	C
I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)			
Elective – II	**3**	**0**	**3**

(R11AMS2109) MECHATRONICS

UNIT I:

Introduction: Definition of Mechatronics products, Design Considerations and Tradeoffs, Overview of Mechatronic products. Intelligent Machine vs Automatic. Machine Economic and social justification.

Actuators and Motion Control: Characteristics of Mechanical, electrical, Hydraulic and pneumatic actuators and their limitations. Control parameters and system objectives. Mechanical configurations. Popular control system configurations. S-curve, Motor/Load inertia matching, design with linear slides.

UNIT II:

Motion control Algorithms: significance of feed forward control loops, shortfalls, Fundamental concepts of adaptive and fuzzy control. Fuzzy logic compensatory control of transformation and deformation non-Z linearities.

UNIT III:

Architecture of intelligent Machines: Introduction to Microprocessor and programmable logic controllers and identification of system, System design Classification. Motion control aspects in Design.

UNIT IV:

Manufacturing Data Bases: Data Base management system, CAD/CAM Data bases, Graphic Data Base, Introduction to object oriented concepts, objects oriented model language interface, procedures and methods in creation, edition and manipulation of data.

UNIT V:

Sensor Interfacing: Analog and Digital Sensors for Motion Measurement, Digital Transducers, Human — Machine and Machine — Machine Interfacing devices and strategy.
Machine Vision: Feature and Pattern Recognition methods, concepts of perception and cognition in decision making.

References:

1. Control sensors and actuators, “Designing Intelligent Machines”, Open University, London
2. Michel B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement systems” Tata McGraw Hill.
3. I. C.W. De Silva, “Control sensors and actuators”, 2 Edition, Prentice Hall.

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective – II	**3**	**0**	**3**

(R11AMS2110) THEORY OF ELASTICITY AND PLASTICITY

UNIT I:
Elasticity: Two dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility - Stress function - Boundary conditions.

UNIT II:
Problem in rectangular coordinates: Solution by polynomials - Saint Venent's principles - Determination of displacement - Simple beam problems.
Problems in polar coordinates: General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT III:
Analysis of stress and strain in three dimensions: Principle stresses - Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.
General theorems: Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

UNIT IV:
Bending of prismatic bars: Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.
Plasticity: Plastic deformation of metals - Structure of metals - Deformation - Creep stress relaxation of deformation - Strain rate condition of constant maximum shear stress - Condition of constant strain energy - Approximate equation of plasticity.

UNIT V:
Methods of solving practical problems: The characteristic method - Engineering method - Compression of metal under press - Theoretical and experimental data drawing.

References:

1. Theory of Elasticity by Timoshenko, S.P. and Goodier, J.N.
2. An Engineering Theory of Plasticity by E.P. Unksov.
3. Applied Elasticity by W.T. Wang.
4. Theory of Plasticity by Hoffman and Sacks.

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I Year – I Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	0	**3**	**2**

(R11AMS2201) MANUFACTURING SIMULATION & PRECISION ENGINEERING LABORATORY

MANUFACTURING SIMULATION LABORATORY

1. Simulation of Continuous Time Systems and Discrete Time Systems.
2. Simulation of Queuing Systems
3. Simulation of Inventory Systems.
4. Simulation of Flexible Manufacturing Systems.
5. Simulation of Job Shop Production Systems.

(Problems may include AGV Planning, ASRS Simulation, JIT System, Kanban flow, MRP, Shop Floor scheduling, Material Handling Systems)

Packages: *Use of* ***Flexsim, AutoMOD, PROMOD, SLAM-H, CAFINS*** *Software etc*

PRECISION ENGINEERING LABORATORY

1. Study of Chip formation in Turning Process.
2. Determination of Cutting forces in Turning.
3. Study of operation of Tool & Cutter grinder, Centreless grinder.
4. Inspection of parts using Toolmakers Microscope, Roughness and Form tester
5. Hydraulic and Pneumatic Circuits.
6. Closed Loop Control Systems.
7. Studies in Programming Logic Controllers (PLC) programming.
8. Studies of Micro Controllers.
9. Study and programming of Robots.

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2111) SIMULATION MODELING OF MANUFACTURING SYSTEMS

UNIT I:

Introduction: 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 in Hypothesis – Type I & II errors - 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 - Bernoullie - 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 WMJI 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.

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, 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/TahaHA./PH,Englewood Cliffs, NJ, 1987

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2112) QUALITY ENGINEERING IN MANUFACTURING

UNIT I:

Quality Value and Engineering: An overall quality system, Quality engineering in product design, Quality engineering in design of production processes, Quality engineering in production.

Loss Function and Quality Level: Derivation and use of Quality Loss Function (QLF), Economic consequences of tightening tolerances as a means to improve quality, Evaluations and types tolerances - N-type, S-type and L-type.

UNIT II:

Analysis of Variance (ANOVA): NO - way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT III:

Orthogonal Arrays: Introduction to OA, Degrees of Freedom, Structure of OA, Linear Graphs & Interaction tables, Strategies in Experimentation - Typical test strategies, Better test strategies & Efficient test strategies, Steps in designing, conducting and analyzing an experiment.

Interpolation of Experimental Results: Interpretation methods, Percent contribution, Estimating the mean.

UNIT IV:

Tolerance Design and Tolerancing: Functional limits, Tolerance design for N-type, L-type and S-type characteristics, Tolerance allocation for multiple components.

Parameter and Tolerance Design: Introduction to parameter design, Signal to noise ratios, Parameter design strategy, Some of the case studies on parameter and tolerance designs.

UNIT V:

Quality Tools: ISO-9000 Quality System, Business Process Re-engineering (BPRE), Six-sigma, Bench making, Quality circles, Brain Storming, Fishbone diagram.

Text Books:

1 . Taguchi Techniques for Quality Engineering /Phillip J. Ross/ McGraw Hill, Intl. II Edition, 1995.

References:

1 . Quality Engineering in Production systems / G. Taguchi, A- Elsayed et al / McGraw Hill Intl. Edition, 1989.

2. Taguchi Methods explained: Practical steps to Robust Resign / Tapan P. Bagchi /Prentice Hall Ind. Pvt. Ltd., New Delhi.

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems) **L P C**
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(R11AMS2113) COMPUTER AIDED MANUFACTURING

UNIT I:

Computer-Aided Programming: General information, APT programming, Examples Apt programming problems (2D rnachining only), NC programming on CAD/CAM systems, the design and implementation of post processors, Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT II:

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified toois, coolant fed tooling system, Modular fixturing, Quick change tooling system, automatic head changers,

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

UNIT III:

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, th creation of a DAPP - based Post Processor.

UNIT IV:

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory: counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications and Programming of Micro Controllers.

Programming Logic Controllers (PLC's): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

UNIT V:

Computer Aided Process Planning: Hybrid CAAP System, Computer Aided Inspection and Quality Control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods

Artificial Intelligence and Expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

Text Books:

1 . Computer Control of Manufacturing Systems / Yoram *Koren I* Me Graw Hill. 1 983.
2. Computer Aided Design Manufacturing - K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, HI, 2008.

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	3	**0**	**3**

(R11AMS2114) PRODUCTION AND OPERATIONS MANAGEMENT

UNIT I:

Operations Management: - Definition - Objectives –Types of production systems - historical development of operations management - Current issues in operation management. **Product design:** Requirements of good product design - product, development- approaches - concepts in product development - standardization - simplification – Speed to market - Introduction to concurrent engineering.

UNIT II:

Value engineering: - Objective - Types of values - Function & cost - Product life cycle - Steps in value engineering - Methodology in value engineers - FAST Diagram - Matrix Method.

Location: Facility location and layout - Factors considerations in Plant location- Comparative Study of rural and urban sites - Methods of selection plant layout - objective of good layout - Principles - Types of layout -line balancing.

UNIT III:

Aggregate Planning - Definition - Different Strategies - Various models of Aggregate Planning – Transportation and graphical models

Advance inventory control systems: Push systems - Material Requirement - Terminology - Types of demands - Inputs to MRP - Techniques of MRP - Lot sizing methods - Benefits and drawbacks of MRP - Manufacturing Resources Planning (MRP -II), Pull systems Vs Push system - Just in time (JIT) philosophy - Kanban System - Calculation of number of Kanbans - Requirements for implementation of JIT - JIT Production process - Benefits

UNIT IV:

Scheduling: Policies - Types of scheduling - Forward and Backward Scheduling - Grant Charts - Flow shop Scheduling - n jobs and 2 machines, n jobs and 3 machines -job shop Scheduling - 2 jobs and n machines - Line of Balance.

UNIT V:

Project Management: Programming Evaluation Review Techniques (PERT) - Three times estimation – Critical path - Probability of completion of project - Critical path method - Crashing of simple nature.

References:

1 "Operations Management " by E.S. Buffs
2 "Operations Management 'Theory and Problems: by Joseph G. Monks.
3 "Production Systems Management" by James I. Riggs.
4 "Production and Operations Management" by Chary.
5 "Operations Management " by Chase
6 "Production and Operation Management" by Panner Selvam
7 "Production and Operation Analysis" by Nahima

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective - III	**3**	**0**	**3**

(R11AMS2115) 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 modais controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT II:

Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control; robot dynamics, configuration of robot controller,

UNIT III:

End Effectors: Grippers - Types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. Sensors; Desirable features, tactile, proximity and range sensors, uses sensors in robotics'

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.

UNIT IV:

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations.

Robot Languages: Textual robot languages, Generation, Robot language structures, Elements in function.

UNIT V:

Robot Cell Desgin and Control: Robot cell layouts-Robot centered cell, In-line robot dell, Considerations in work design, Work and control, Inter locks, Error detect ion, Work eel 1 controller.

Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly Inspection, Feature Application.

Text Books:

1. Industrial robotics, Mikell P.Groover/McGraw Hill.
2. Robotics, K.S.Fu / McGraw Hill .

I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	L	P	C
Elective - III	3	0	3

(R11AMS2116) TOOL DESIGN

UNIT I:

Tool Materials: Prosperities of materials- Tools steels, Cast Iron, Mild or low carbon steels, Non metallic and nonferrous materials, Meat treating

UNIT - II:

Design of Cutting Tools: Single Point cutting tools: Milling cutters, Drills, Selection of carbide steels - Determination of shank size for single point carbide tools, determining the insert thickness for carbide tools

UNIT - III:

Design of Jigs And Fixtures: Basic principles of location and clamping: Locating methods and devices, Jigs-Definition Types, General considerations in the design of Drill jigs, Drill bushing, Methods of Construction. Fixtures- Vice fixtures, Milling, Boring Lathe Grinding fixtures.

UNIT -IV:

Design of Sheet Metal Blanking and Piercing Dies: Fundamentals of Die cutting operation, Power press types, General press information, Materials Handling equipment. Cutting action in Punch and die operations. Die clearance, Types of Die construction. Die design fundamentals-Banking and piercing die construction, pilots, stripper and pressure pads presswork material, Strip layout, Short run tooling for piercing.

UNIT- V:

Design of Sheet Metal Bending, Forming and Drawing Dies: Bending dies, Drawing dies, Forming dies, Drawing operations, Variables that effect metal flow during drawing. Determination of blank size, Drawing force, Single and double action draw dies.

Texts Books:

1. Donaldson "Tool Design", Tata McGraw Hill
2. George F Dieter "Mechanical Metallurgy" Tata McGraw Hill

References:

1. Taylour Altm, Sool Ik-Oh and Harold L. Gegel - "American Society for Metals", 1983.
2. Kurt Lange, "Hand Book of Metal forming", Me Graw-Hill, 1987.

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective - III	**3**	**0**	**3**

(R11AMS2117) DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS

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 Force, 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 Nanoscale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in submicrometer 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. Tai-Ran Hsu, MEMs & Microsystems: Desjgn & Manufacture, Tata McGraw Hill, ed., 2002

References:

1 . Maluf, M. "An Introduction to Microelectromechanical Systems Engineering", Artech House, Boston, 2000
2. Trimmer, W.S.N. "Micro robots and Micromechanical Systems", Sensors & Actuators, Vol 9, 1989.
3. Trim, D.W. "Applied Partial Differential Equations" VPWS-Kent Publishing, Boston 1990.
4. Madou, M. "Fundamentals of Microfabrication", CRC Press, Boca Raton, 1997.
5. Hsu, T.R. "The Finite Element Method in Thermomechanics", Alien & Unwin, London.

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective - IV	**3**	**0**	**3**

(R11AMS2118) PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS

UNIT I:

Manufacturing Systems & Control: Automated Manufacturing Systems - Modeling - Role of performance modeling - Simulation models - Analytical models. Product cycle - Manufacturing automation - Econornics of scale and scope - input/output model - plant configurations. Performance measures - Manufacturing lead time - Work in process - Machine utilization, - Throughput - Capacity - Flexibility - Performability - Quality Control Systems - Control system architecture - Factory communications - Local area network interconnections - Manufacturing automation protocol - Database management system.

UNIT II:

Manufacturing Processes: Examples of stochastic processes - Poisson, Process - Discrete time

Markov chain models - Definition and notation - Sojourn times in states - Examples of DTMGs in manufacturing - Chapman - Kolmogorov equation - Steady-state analysis. Continuous Time Markov Chain Models - Definitions and notation - Sojourn times in states - examples of CTMCs in manufacturing - Equations for CTMC evolution - Markov model of a transfer line: Birth and Death Processes in Manufacturing;-- Steady j&tate analysis of BD Processes - Typical BD processes in manufacturing.

UNIT III:

Queuing Model: Notation for queues - Examples of queues in manufacturing systems Performance measures-Little's result- Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns -Analysis of a flexible machine center.

UNIT IV:

Queuing Networks: Examples of QN models in manufacturing - Little's law in queuing networks -Tandem queue -An open queuing network with feedback -An open central server model for FMS –Closed transfer line - Closed server model - Garden Newell networks.

UNIT V:

Petrinets: Classical Petrinets - Definitions -Transition firing and reachability - Representational power properties - Manufacturing models. Stochastic Petri Nets - Exponential timed Petrinets - Generalized Stochastic Petrinets - Modeling of KANBAN systems - Manufacturing models.

Text Book:

1. Viswanadham, N and Narahari, Y. "Performance Modelling of Automated Manufacturing Systems", Prentice Hall of India, New Delhi, 1994

References:

1. Trivedi, K.S. "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall, New Jersey, 1982.
2. Gupta S.C. & Kapoor V.K. "Fundamentals of Mathematical Statistics", 3rd Edition, Delhi, 1988

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective - IV	**3**	**0**	**3**

(R11AMS2119) COMPUTATIONAL FLUID DYNAMICS

UNIT I:

Introduction: Finite difference method, finite volume method, finite element method, boundary conditions, Derivation of finite; difference equations

Solution methods: Solution methods of elliptical equations - finite difference formulations, interactive solution Methods, direct method with Gaussian elimination. Parabolic equations - explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT II:

Hyperbolic equations: Explicit schemes and Von Neumann stability analysis, implicit schemes, multislep methods, nonlinear problems, second order one-dimensional wave equations Burgers equations: Explicit and implicit schemes, Runge - Kutta method.

UNIT III:

Formulations of incompressible Viscous flows: Formulation of incompressible viscous flows by difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: Potential equation, Euler equations, Navier-stokes system of equations, flow field - dependent variation methods, boundary conditions, example problems.

UNIT IV:

Finite volume method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT V:

Standard Variational methods - 1: Linear fluid flow problems, steady state problems, Transient problems

Text Book:

1. Computational Fluid Dynamics, T. J. Chung, Cambridge University press, 2002.

Reference:

1. Text book of fluid dynamics, Frank Choriton, CBS Publishers & distributors, 1985.

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
Elective - IV	**3**	**0**	**3**

(R11AMS2120) INTELLIGENT MANUFACTURING SYSTEMS

UNIT I:

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

UNIT II:

Components of Knowledge Based Systems — Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition

UNIT III:

Machine Learning — Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks -Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT IV:

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

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 (KBSCIT) — Data Base, Knowledge Base, Clustering Algorithm.

Text Books:

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

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I Year – II Sem. M.Tech. (Advanced Manufacturing Systems)	**L**	**P**	**C**
	0	**3**	**2**

(R11AMS2202) CAD/CAM LAB

CAD LAB

Drafting : Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting.

Part Modeling : Generation of various 3D Models through Protrusion, revolve, shell sweep, Creation of various features, Study of parent child relation, Feature based and Boolean based modeling surface and Assembly Modeling, Design of machine components.

CAM LAB

- Practice in part programming and operation of CNC Turning & Milling machines, subroutine techniques and use of cycles
- Tool planning and selection of sequences of operations; Tool setting on machine
- Practice in APT based NC programming.
- Practice in Robot programming and its languages
- Robotic simulation using software
- Simulation of manufacturing system using CAM software, controller operating system commands