JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure and syllabi for

M.Tech-M.E-Advanced Manufacturing Systems

Offered by Department of Mechanical Engineering

for affiliated Engineering Colleges 2017-18

I – SEMESTER:

S. No.	Subject Code	SUBJECT	L	T	P	C
1	17D87101	Automation in Manufacturing	4	-	-	4
2	17D87102	Computer Aided Manufacturing	4	-	-	4
3	17D87103	Precision Engineering	4	-	-	4
4	17D87104	Design for Manufacturing and assembly	4	-	-	4
5	17D87105 17D87106 17D87107	ELECTIVE-I a) Special Manufacturing Process b) Product Data Management c) Total Quality Management	4	-	-	4
6	17D87108 17D87109 17D87110	ELECTIVE-II a) Advanced CAD b) Advanced Mechatronics c)Theory of Elasticity and Plasticity	4	-	-	4
7	17D87111	Advanced CAD/CAM Lab	0	-	4	2
TOTAL			**24**	**-**	**4**	**26**

II - SEMESTER:

S.No.	Subject Code	SUBJECT	L	T	P	C
01	17D87201	Simulation Modeling of Manufacturing Systems	4	-	-	4
02	17D87202	Quality Engineering in Manufacturing	4	-	-	4
03	17D15104	Materials Technology	4	-	-	4
04	17D87203	Production and Operations Management	4	-	-	4
05	17D87204 17D04106 17D87205	ELECTIVE-III a) Industrial Robotics b) Advanced Tool Design c) Design and Manufacturing of MEMS and Micro Systems	4	-	-	4
06	17D87206 17D11204 17D87206	ELECTIVE-IV a) Performance Modelling and Analysis of Manufacturing Systems b) Computational Fluid Dynamics c) Intelligent Manufacturing Systems	4	-	-	4
08	17D11211	Manufacturing Simulation Lab	0	-	4	2
TOTAL			**24**	**-**	**4**	**26**

III SEMESTER

S.No	Subject Code	Subject	L	T	P	C
1.	17D20301 17D20302 17D20303	Elective V a) Research Methodology b) Human Values and Professional Ethics c) Intellectual Property Rights	**4**	**-**	**-**	**4**
2.	17D87301	Elective VI (MOOCS)	**-**	**-**	**-**	**-**
3.	17D87302	Comprehensive Viva – Voice	**-**	**-**	**-**	**2**
4.	17D87303	Seminar	**-**	**-**	**-**	**2**
5.	17D87304	Teaching Assignment	**-**	**-**	**-**	**2**
6.	17D87305	Project work phase – I	**-**	**-**	**-**	**4**

IV SEMESTER

S.No	Subject Code	Subject	L	T	P	C
1.	17D87401	Project work Phase – II	-	-	-	12

Project Viva Voce Grades:

A: Satisfactory

B: Not Satisfactory

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M. Tech – I year I Sem. (AMS)

L	T	P	C
4	0	0	4

(17D87101) AUTOMATION IN MANUFACTURING

Course Objective:

At the end of this course

- The course should enable to understand the principles of automation, importance of automated flow lines and its types.
- The Student should be able to understand outline the system configurations used in automated production
- Students should be able to recognize and articulate the foundational assumption of the transfer mechanism, types of transfer mechanism that may be used for work part transfer
- Student able to describe automated assembly systems, and their associated system configurations , list the hardware components used for parts delivery at workstations Outline typical automated assembly processes

UNIT – I

OVER VIEW OF MANUFACTURING AND AUTOMATION: Production systems, Automation in productionsystems, Automation principles and strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT – II:

MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES: Material handling, equipment, Analysis.Storage systems, performance and location strategies, Automated storage systems, AS/RS, types. Automatic identification methods, Barcode technology, RFID.

UNIT – III:

MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES: Manufacturing systems:components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.

UNIT – IV:

AUTOMATED ASSEMBLY SYSTEMS: Fundamentals, Analysis of Assembly systems.Cellularmanufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT – V:

QUALITY CONTROL AND SUPPORT SYSTEMS: Quality in Design and manufacturing, inspectionprinciples and strategies, Automated inspection, contact Vs non contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

REFERENCES:

1. Automation, production systems and computer integrated manufacturing/ Mikell.PGroover/PHI/3rd edition/2012.
2. Automation, Production Systems and CIM/ Mike J P. Grower/PHI
3. CAD/CAM/CIM/ P. **R**adha Krishnan **& S**. Subrahamanyarn and Raju/New Age International Publishers/2003.
4. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
5. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009.

Course Outcome:

- After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- After completion of this course students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- After completion of this course students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines
- Students are able to understand automated transfer and storage system, recognize the equipments used in automated transfer and storage system.

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(17D87102) COMPUTER AIDED MANUFACTURING

Course Objective:

Computer Aided Manufacturing is highly demanded area now a day. Computer Aided Manufacturing deals with Design of components to manufacturing and also includes Planning and controlling the processes. Industries widely use CNC, FMS and Robotics technology now a day. Students will be familiar with its hardware and software and also able to write programs for machining.

UNIT - I

COMPUTE-AIDED DESIGN AND PROGRAMMING: General information, APT programming, Examples Apt programmingprobkms (2D machining only). NC programming on CAD/CAM systems, post processing techniques, Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT - II

TOOLING FOR CNC MACHINES: Interchangeable tooling system, preset and qualified toois, coolant fedtooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding, types of control systems-open loop and closed loop control systems.

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 qualitycontrol, 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.

REFERENCES:

1. Computer Control of Manufacturing Systems / YoramKoren / McGraw Hill. 1983.
2. Computer Aided Design Manufacturing – K. Lalit Narayan, K. MallikarjunaRao and M.M.M. Sarcar, PHI, 2008.
3. CAD/CAM Principles and Applications, P.N.Rao, TMH
4. CAD / CAM Theory and Practice,/ Ibrahim Zeid,TMH
5. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
6. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson

Course Outcome:

After learning the course the students should be able to:

1. Students will describe basic concepts of CAM application and understand CAM wheel

2. Students will prepare CNC programs for manufacturing of different geometries on milling and lathe machines.

3. Students will prepare logic diagram for different application of automation.

4. Students will classify different components using different techniques of group technology.

5. Students will prepare Process planning for different components.

6. Students will select layouts of FMS for industrial applications.

7. Students will describe Robot for preliminary industrial applications like pick and place.

8. Student will identify application of PPC, JIT, MRP-I, MRP-II, and Expert system to CAM.

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L	T	P	C
4	0	0	4

(17D87103) PRECISION ENGINEERING

Course Objective:

- To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering.
- Accuracy and alignment tests.
- Influences of static stiffness and thermal effects.
- Precision machining.
- Nano measuring systems.
- Various lithography techniques.

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 lags.

GEOMETIC DEIMENSIONING 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. 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:

FOUNDAMENTALS OF NANOTECHNOLGY: Systems of nanometer accuracies – Mechanism of metalProcessing – 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 processingpoint-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

REFERENCES:

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.
3. Nano Technology / Norio Taniguchi / Oxford University Press, 1996.
4. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd., London
5. Precision Engineering/VC Venkatesh& S Izman/TMH

Course Outcome:

- Apply fits and tolerances for parts and assemblies according to ISO standards.
- Apply selective assembly concept for quality and economic production.
- Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
- Evaluate the part and machine tool accuracies.

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(17D87104) DESIGN FOR MANUFACTURING AND ASSEMBLY

Course Objective:

- Introduce design principles, properties of materials, fits and tolerances and datum features.
- Understand the influence of materials on form design and able to select possible material and feasible design.
- Introduce design features to facilitate machining and design for mach inability, economy, accessibility and assembly.
- Know about redesign of castings, modifying the uneconomical design, group technology and applications of DFMA.
- Understand the Environmental objectives and issues and to design considering them.

UNIT - I

INTRODUCTION: Design philosophy steps in Design process - General Design rules for manufacturability -basic principles of design Ling for economical production - creativity in design. Materials: Selection of Materials for design Developments in Material technology - criteria for material selection - Material selection interrelationship with process selection process selection charts, material usage and sustainability.

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.

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

UNIT- III

JOINING TECHNIQUES:

METAL JOINING: Appraisal of various welding processes, Factors in design of weldments-general design guidelines - pre and post treatment of welds - effects of thermal stresses in weld joints - design of brazed joints. Forging - Design factors for Forging - Closed dies forging design - parting lines of die5 drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

ADHESIVE BONDING: History of adhesive bonding, adhesives and sealants –working, mechanical properties of the joints, testing of the joints and different failure modes, applications of the joints.

UNIT-IV

ASSEMBLY ADVANTAGES: Development of the assemble process, choice of assemble methodassemble 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 designguidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

REFERENCES:

1. Assembly Automation and Product Design/ Geoffrey Boothroyd/ Marcel Dekker Inc., NY, 1992.
2. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed. 2000.
3. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.
4. Computer Aided Assembly London/ A Delbainbre/.
5. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010
6. Dieter G.E. – Engineering Design –A materials and processing approach.- Mc Graw Hill -1991.
7. R.D. Adams , Adhesive Bonding – First edition.

Course Outcome:

- Select the design principle, suitable material, mechanism, fit and tolerance for designing a product/component.
- Select the appropriate material, proper working principle and a feasible design.
- Design (optimum) a component which requires less material removal, easy to machine, assemble, access and cost effective.
- Redesign the uneconomical casting design and know the applications of DFMA.
- Incorporate the Environmental Objectives, issues and guidelines into the design.

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4	0	0	4

(17D87105) SPECIAL MANUFACTURING PROCESSES

ELECTIVE – I

Course Objective:

- To teach the students to understand the fundamentals of manufacturing and prototyping for product design and development.
- To teach the students to gain practical experience in manufacturing and prototyping for product design and development.
- To teach the students to develop ability to apply up-to-date technology in manufacturing products with considerations of safety and environmental factors.

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 particulateceramics, 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:

Nano manufacturing techniques and micromachining, High Speed Machining andhot machining. Internet based e-manufacturing covers the range of manufacturing activities for products and services, including product design, production control and condition monitoring, supply chain management, maintenance and sales and services through the internet.

UNIT -V

RAPID PROTOTYPING:

Working Principles, Methods, Stereo Lithography, Laser Sintering, FusedDeposition Method, Applications and Limitations, Rapid tooling, Techniques of rapid manufacturing

REFERENCES:

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 NostrandRenihold,
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*I*McGraw Hill.
7. E-manufacturing applications and potentials – Kaiecherg, Richard,J. Bateman," Progress in Natural Science vol 18,Issue 11, November 2008, PP 1323-1328.

Course Outcome:

- Describe the principle and operation of common manufacturing and rapid prototyping processes for product development.
- Decide on the use of appropriate manufacturing processes in the manufacture of a product at the design stage.
- Develop a prototype with modern prototyping techniques.
- Apply up-to-date technology in manufacturing products with considerations of safety and environmental factors.
- Apply the reverse engineering process for product development.
- Appreciate and report on the common practice in the product development industry.

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4	0	0	4

(17D87106) PRODUCT DATA MANAGEMENT
ELECTIVE – I

Course Objective:

1. Familiarize the current principles, practices, and applications of Product Lifecycle Management (PLM).
2. Aware that the sustainable design of product and process and the early consideration of the constraints and factors become more important to successfully develop competitive products.
3. Learn integrated, information driven approach to all aspects of a product's life from its design inception, through its manufacture, deployment and maintenance, and culminating in its removal from service and final disposal.
4. Aware that PLM technology is playing a critical role in most of the modern industries including aerospace, automobile, medical, etc.
5. Experience effective integration of PLM technologies into the product development process that can put the industry at a competitive advantage to deliver innovative products ! Experience modern PLM strategies, methods, and tools.

UNIT- I

Introduction -Need for IPPD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – 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 –Externally and internally – explore systematically – reflect on the solutions and process – concept selection– methodology – benefits.

PRODUCT ARCHETECTURE: 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 PRODUCTY DEVELOPMENT: Definition – Estimation of manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity. Prototype basics – Principles of prototyping – planning for prototypes – Economics analysis – Understanding and representing tasks – baseline project planning – accelerating the project execution.

REFERENCES:

1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger / McGraw Hill International Edns. 1999.
2. Concurrent Engg/integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)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 0-202-41369-5.
5. Production and Operations Management/Chase/TMH

Course Outcome:

After students complete this course, they will be able to: -

1. Remember the reasons for adopting PLM strategies and methods.
2. Indentify PLM's impacts on corporate strategy, structure and operations.
3. Distinguish product development processes.
4. Distinguish associated engineering information with the product development process.
5. Construct and manage product data using PLM/PDM technologies.
6. Construct managed product data during the PD process.
7. Defend information technology for supporting product development process.
8. Distinguish the challenges in product data integration in product lifecycle.
9. Construct general strategies and principles for the successful implementation.

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4	0	0	4

(17D87107) TOTAL QUALITY MANAGEMENT

ELECTIVE – I

Course Outcome:

- Implement the principles and concepts inherent in a Total Quality Management (TQM) approach to managing a manufacturing or service organization.
- Explain the system of documentation, implementation and assessment of quality
- Assess exactly where an organization stands on quality management with respect to the ISO 9000 quality management standard.
- Develop a strategy for implementing TQM in an organization

UNIT – I:

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude and involvement of topmanagement, 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: The importance of customer satisfaction and loyalty- Cratingsatisfied customers, Understanding the customer needs, 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 thetransition 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 ofQuality Cost Information, Accounting Systems and Quality Management.

UNIT – V:

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

REFERENCES:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI
3. Beyond TQM / Robert L.Flood
4. Statistical Quality Control / E.L. Grant / McGraw Hill.
5. Total Quality Management- A Practical Approach/H. Lal
6. Quality Management/KanishkaBedi/Oxford University Press/2011
7. Total Engineering Quality Management/Sunil Sharma/Macmillan

Course Objective:

- Develop an understanding on quality management philosophies and frameworks.
- Develop in-depth knowledge on various tools and techniques of quality management.
- Learn the applications of quality tools and techniques.
- Develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those.

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4	0	0	4

(17D87108) ADVANCED CAD

ELECTIVE – II

Course Objective:

- Model the 3D geometric information of machine components including assemblies, and automatically generate 2- D production drawings, understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.
- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.
- Model complex shapes including freeform curves and surfaces,
- Integrate the CAD system and the CAM system by using the CAD system for modeling design Information and converting the CAD model into a CAM model for modeling the manufacturing Information.
- Use full scale CAD/CAM software systems designed for geometric modeling of machine Components and automatic generation of manufacturing information.

UNIT- I:

PRINCIPLES OF COMPUTER GRAPHICS : Introduction, graphic primitives, point plotting, lines,Bresenham's circle algorithm, ellipse, transformation in graphics, coordinate systems, view port, 2D and 3D transformation, hidden surface removal, reflection, shading and generation of characters.CAD –modeling of curves, surfaces and solids manipulation of CAD models, features based modeling, product data exchange standards.

UNIT- II

CAD TOOLS: Definition of CAD Tools, Types ofsystemCAD/CAMsystemevaluation criteria, brieftreatment of input and outputdevices.Graphicsstandard, functionalareas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.

GEOMETRICMODELLING: Types of mathematical representation of curves, wire frame models wire frameentities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves.

UNIT- III:

SURFACE MODELING :Mathematical representation surfaces, Surface model, Surface entities surfacerepresentation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

UNIT- IV:

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES:

HermiteBicubic surface, **Bezier** surface, **B-** Spline surface, COONs surface, Blending surface Sculptured surface, Surface manipulation — Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT- V:

GEOMETRICMODELLING-3D: Solid modeling, Solid Representation, BoundaryRepresentation (13-rep), Constructive Solid Geometry (CSG).

CAD/CAM Exchange : Evaluation of data - exchange format, IGES data representations and structure,STEP Architecture, implementation, ACIS & DXF. Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

REFERENCES :

1. Mastering CAD/CAM / IbrhimZeid / McGraw Hill International.
2. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
3. CAD/CAM /Groover M.P./ Pearson education
4. CAD/CAM Concepts and Applications/ Alavala/ PHI
5. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age
6. Principles of Computer Aided Design and Manufacturing/ FaridAmirouche/ Pearson
7. Computer Numerical Control Concepts and programming/ Warren S Seames/ Thomson.

Course Outcome:

- Understand the concepts of wireframe, surface and solid modeling.
- Understand part modeling and part data exchange standards (VDA, IGES, and STEP).
- Develop knowledge in 2D-Transformations, 3D Transformations.
- Understand the Assembly Modeling, Assembly tree, and Assembly Methods.
- The Students become experts on Visualization and computer animation Techniques.

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L	T	P	C
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(17D87109) ADVANCED MECHATRONICS

ELECTIVE – II

Course Objective:

For students to Develop skills and confidence to create your own custom microcontroller-based electronics projects via:

1. A review basic electronics (e.g., filters, op. amps, transistors…).
2. Learning to interface electrical peripherals (e.g., A/D, D/A, Sensors, Motors, Timers, Interrupts, Serial Communication) with a microcontroller through focused lab exercises and a term project.
3. Knowledge of feature in mechatronics and related technology innovation.

UNIT-I

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC.Analog signal conditioning, amplifiers, filtering.Introduction to MEMS & typical applications.

UNIT-III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition, DAQS , SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

REFERENCES:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran& GK VijayaRaghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
3. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
4. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
5. Mechatronics System Design / Devdasshetty/Richard/Thomson.
6. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
7. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton
8. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print

Course Outcome:

1. Select and apply the knowledge, skills and modern tools in mechatronics engineering.
2. Apply concepts of circuit analysis, automation and controls, motor, electronic drives, paper systems, instrumentation and trouble shooting and mechatronic systems.

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M. Tech – I year I Sem. (AMS)

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(17D87110) THEORY OF ELASTICITY AND PLASTICITY

ELECTIVE – II

Course Outcome:

1. To impart knowledge of engineering application of plasticity.
2. To know the classical theory of elasticity.
3. To recognize typical plastic yield criteria.

UNIT - I

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

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 distributionsymmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT - II

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS: Principle stresses - Homogeneousdeformations - Strain spherical and deviatoric stress - Hydrostatic strain.

General theorems: Differential equations of equilibrium and compatibility - Displacement - Uniqueness ofsolution - Reciprocal theorem.

UNIT - III

BENDING OF PRISMATIC BARS: Stress function - Bending of cantilever beam - Beam of rectangularcross-section - Beams of circular cross-section.

UNIT - IV

PLASTICITY: Plastic deformation of metals - Structure of metals - Deformation - Creep stress relaxation ofdeformation - 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/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. An Engineering Theory of Plasticity/E.P. Unksov/Butterworths
3. Applied Elasticity/W.T. Wang/TMH
4. Theory of Plasticity for Engineers/Hoffman and Sacks/TMH
5. Theory of Elasticity and Plasticity/Sadhu Singh/ Khanna Publishers
6. Theory of Elasticity and Plasticity/Harold Malcolm Westergaard/Harvard University Press

Course Outcome:

1. To understand the physical interpretation of material constraints in mathematical formulation of constitutive relationships.

2. Solve analytically the simple boundary value problems with elasto-plastic properties.

3. Develop constitutive models based on experimental results.

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M. Tech – I year I Sem. (AMS)

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(17D87111) ADVANCED CAD/CAM LAB

Course Objective:

- Model the 3D geometric information of machine components including assemblies, and automatically generate 2- D production drawings, understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.

- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.

- Model complex shapes including freeform curves and surfaces,

- Integrate the CAD system and the CAM system by using the CAD system for modeling design Information and converting the CAD model into a CAM model for modeling the manufacturing Information.

- Use full scale CAD/CAM software systems designed for geometric modeling of machine Components and automatic generation of manufacturing information.

1. Features and selection of CNC turning and milling centers.

2. Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles.

3. Practice in part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine, practice in APT based NC programming.

4. Practice in Robot programming and its languages.

5. Robotic simulation using software. Robo path control, preparation of various reports and route sheets, Simulation of manufacturing system using CAM software, controller operating system commands

Course Outcome:

- Understand the concepts of wireframe, surface and solid modeling.

- Understand part modeling and part data exchange standards (VDA, IGES, and STEP).

- Develop knowledge in 2D-Transformations, 3D Transformations.

- Understand the Assembly Modeling, Assembly tree, and Assembly Methods.

- The Students become experts on Visualization and computer animation Techniques. Note: Conduct at least any10 exercises from the list given below:

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(17D87201) SIMULATION MODELING OF MANUFACTURING SYSTEMS

Course Objective:

- To provide knowledge simulation and simulation steps.
- To provide knowledge on parameter estimation and hypothesis.
- To provide knowledge on building simulation model how to validation and verification is done.
- To provide knowledge on Generation of random variants and variables.
- To provide knowledge on some Simulation languages.
- To provide knowledge on some Applications of Simulation.

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- step - types l& 2 errors - Framing - string 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 variables - 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 - S1MAN- SIMSCRIPT - Simulation of WMJI queue - comparison of simulation languages.

UNIT - IV

Output data analysis - Types of Simulation w. r. t output data analysis – warm up period- Welch algorithm - Approaches for Steady - State Analysis - replication - Batch means methods - corn pan Sons.

UNIT - V

Applications of Simulation - flow shop system - job shop system - M/MI1 queues with infinite and finite capacities - Simple fixed period inventory system – New boy paper problem.

REFERENCES:

1. Simulation Modelling and Analysis / Law, A.M.&Kelton / McGraw Hill, Edition/ New York, 1991.
2. Discrete Event System Simulation *I* Banks J. & Carson J.S., PH *I* Englewood Cliffs N/ 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 S1MNET/ Taha HA. / PH, Englewood Cliffs, NJ, 1987

Course Outcome:

- Students gain knowledge on various types of simulation and simulation languages steps in simulation and applications of simulation.
- Students gain knowledge on parameter estimation and hypothesis.
- Students can build simulation model and also can validation and verify model.
- Can Generation of random variants and variables.

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(17D87202) QUALITY ENGINEERING IN MANUFACTURING

Course Objective:

1. Explore knowledge of basic sciences engineering and manufacturing process.
2. Manage projects in various sectors of economy which facing on conceptual , technological and human aspects.
3. Identify the bottle ends and production process.
4. Similarity of the manufacturing process to analyze the overall performance.

UNIT - I

QUALITY VALUE AND ENGINEERING: An overall quality system, quality engineering in productiondesign, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT II:

TOLERANCE DESIGN AND TOLERANCING: Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr 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 – III

ANALYSIS OF VARIANCE (ANOVA): Introduction to ANOVA, Need for ANOVA, NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV

ORTHOGONAL ARRAYS: Typical test strategies, better test strategies, efficient test strategies, steps indesigning, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V

SIX SIGMA AND THE TECHNICAL SYSTEM: Six sigma DMAIC methodology, tools fpr processimprovement, six sigma in services and small organizations, statistical foundations, statistical methodology.

REFERENCES:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.
2. Quality Engineering in Production systems *I* G. Taguchi, A. Elsayed et al /Mc.Graw Hill Intl. Edition, 1989.
3. Taguchi Methods explained: Practical steps to Robust Design /Papan P. Bagchi*I* Prentice Hall Pvt. Ltd., New Delhi.

Course Outcome:

1. Applications of the user friendly software packages to simulate the manufacturing entities.
2. Analyze the data by using different performance analysis techniques.
3. Modeling various operators in manufacturing systems.

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(17D15104) MATERIAL TECHNOLOGY

Course Objective:

- To gain and understanding of the relationship between the structure, properties, processing, testing and applications of strengthening mechanism, modern metallic, smart, non-metallic, advanced structural ceramic and composite materials so as to identify and select suitable materials for various engineering applications.

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:

Griffth'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 paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

MODELING AND SIMULATION IN MATERIALS ENGINEERING:

Importance of modeling and simulation in materials engineering and numerical approaches, Numerical solutions of ODEs and PDEs, implicit methods, simple models for simulating microstructures, FE modeling of 1D, variationalapproach.

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, Inter metallics, 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 Techniquesfor Fibers, Foams, Adhesives and Coatings, structure, Properties and Applications of Engineering Polymers, Advanced Structural Ceramics WC, TiC, TaC, A12 O3, SiC, Si3 N4, CBN and Diamond – properties, Processing and applications.

REFERENCES:

1. Mechanical Behavior of Materials/Thomas H. Courtney/ McGraw Hill/2 nd Edition/2000
2. Mechanical Metallurgy/George E. Dicter/McGraw Hill, 1998.
3. Selection and use of Engineering Materials 3e/Charles J.A/Butterworth Heiremann.
4. Engineering Materials Technology/James A Jacob Thomas F Kilduff/Pearson
5. Material Science and Engineering/William D Callister/John Wiley and Sons

Course Outcome:

- Students will get knowledge on mechanism of plastic deformation and strengthening mechanism. Students will be able to learn the structure, properties and applications of modern metallic materials, smart materials non-metallic materials and advanced structural ceramics. Students will be able to understand the importance of advanced composite materials in application to sophisticated machine and structure of components.

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(17D87203) PRODUCTION AND OPERATIONS MANAGEMENT

Course Objective:

- The objective is to introduce concepts and techniques related to the design, planning, control and improvement of businesses in both manufacturing and service sectors.
- This course aims at developing a focus and critical thinking important to solve problems in the operations of business. The students will be required to understand and apply the tools of management learned in the course to practical situations.
- To produce the desired product this has marketability at the most affordable price by properly planning the manpower, material and processes.
- To achieve the objective of delivering the right goods of right quantity as well as quality, at right place and at right time one needs to understand and apply the concepts of Production and operations management.
- Efficient Advanced Production and operations management, give benefits to various sections including consumers, investors, employees, suppliers and community in different ways.

UNIT -I

OPERATION MANAGEMENT: Definition – Objectives – Types of production systems – historicaldevelopment 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 valueengineering – 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 JIT – JIT Production process – benefits of JIT.

UNIT - IV

SCHEDULING: Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts – Flowshop 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/ E.S. Buffs/ John Wiley & Sons / 2007
2. Operations Management Theory and Problems/ Joseph G. Monks / Macmillan / McGraw Hill / 3rd Edition.
3. Production Systems Management/ James I. Riggs / John Wiley & Sons.
4. Production and Operations Management/ Chary/ McGraw Hill/2004
5. Operations Management/ Richard Chase/ McGraw Hill/2006
6. Production and Operation Management / PannerSelvam / PHI.
7. Production and Operation Analysis/ Nahima/ McGraw Hill/2004

Course Outcome:

- Able to understand the principles of production and operations Management
- Understand the operations process, be able to analyze and solve problems pertaining to operations.
- Understand some of the mathematical models of production management.
- Appraise how other functional areas of business are integrated with Operations Management.

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(17D87204) INDUSTRIAL ROBOTICS

ELECTIVE – III

Course Objective:

- To be familiar with the automation and brief history of robot and applications.
- To give the student familiarities with the kinematics of robots.
- To give knowledge about robot end effectors and their design.
- To learn about Robot Programming methods & Languages of robot.
- To give knowledge about various Sensors and their applications in robots

UNIT - I

INTRODUCTION: Automation and Robotics, Robot anatomy, robot configuration, motions joint notationwork 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 forwardtransformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT - III

END EFFECTORS: Grippers-types, operation, mechanism, force analysis, tools as end effectorsconsideration 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 todigital 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, Motioninterpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations.

ROBOT LANGUAGES: Textual robot Languages, Generation, Robot language structures, Elements infunction.

UNIT - V

ROBOT CELL DESGIN AND CONTROL: Robot cell layouts-Robot centered cell, In-line robot cell,Considerations in work design, Work and control, Inter locks, Error detect ion, Work wheel controller. **ROBOT APPLICATION**: Material transfer, Machine loading/unloading. Processing operation, Assembly andInspection, Feature Application.

REFERENCES:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.
3. Robotics / Fu K S/ McGraw Hill.
4. Robotic Engineering / Richard D. Klafter, Prentice Hall
5. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
6. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pte Ltd.
7. Robotics and Control / Mittal R K &Nagrath I J / TMH

Course Outcome:

- Students will be equipped with the automation and brief history of robot and applications.
- Students will be familiarized with the kinematic motions of robot.
- Students will have good knowledge about robot end effectors and their design concepts.
- Students will be equipped with the Programming methods & various Languages of robots.
- Students will be equipped with the principles of various Sensors and their applications in robots

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(17D04106) ADVANCED TOOL DESIGN

ELECTIVE – III

Course Objective:

1. To describe tool design methods and punch and die making/manufacturing techniques.
2. To understand the principles of clamping, drill jigs.
3. To understand the principles of dies and molds design.

UNIT – I:

TOOL MATERIALS:

Prosperities of materials: Tools steels, Cast Iron, Mild or low carbon steels, Non metallic and nonferrous materials, Heat 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.

REFERENCES:

1. Donaldson "Tool Design"/ Tata McGraw Hill
2. Production Technology/HMT/Tata McGraw Hill/
3. Production Technology by R.K. Jain and S.C. Gupta.
4. Mechanical Metallurgy/ George F Dieter/ Tata McGraw Hill
5. Machine Tools/C Elanchezhian& M. Vijayan/Anuradha Publications
6. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency
7. Hand Book of Metal forming/ Kurt Lange/ Mc Graw-Hill,.1987

Course Outcome:

1. Students will be familiar with cutting tools and cutting fluids, machine tools, metal forming etc,.

2. Applications of different techniques learned above in the real world.

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(17D87205) DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS

ELECTIVE – III

Course Objective:

- To learn about electromechanical design and packaging of micro devices and systems.
- To learn of the basic design principles for MEMS and Microsystems.
- To learn the basic principles of micro fabrication techniques for micro devices and micro systems, as well as integrated circuits.
- To learn the basic principles involved in micro systems packaging.
- To learn the basic principle of nano technology and nano scale engineering analysis

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 fluidies.

UNIT II:

ENGINEERING SCIENCE FOR MICROSYSTEMS DESIGN AND FABRICATION:

Atomic structure of Matter, Ions and Ionization, Molecular Theory of Mater 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 Meso scales, 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

REFERENCES:

1. MEMs & Microsystems: Design & Manufacture/ Tai-Ran Hsu/Tata Mc-Graw Hill., ed./2002
2. An Introduction to Microelectromechanical Systems Engineering/ Maluf, M./ Artech House, Boston, 2000
3. Micro robots and Micromechanical Systems/ Trimmer, W.S.N/ Sensors & Actuators, vol19, no.1989.
4. Applied Partial Differential Equations/ Trim, D.W/ PWS-Kent Publishing/ Boston 1990.
5. Fundamentals of Microfabrication. Madou, M/ CRC Press, Boca Raton, 1997.
6. The Finite Element Method in Thermomechanics/ Hsu, T.R / Alien &Unwin, London.

Course Outcome:

- To be able to explain what MEMS and micro systems
- To explain the working principles of many MEMS and micro systems in the market place.
- To understand the relevant engineering science topics relating to MEMS and micro systems.
- To be able to distinguish the design, manufacture and packaging techniques applicable to micro systems from those for integrated circuits.
- To become familiar with the materials, in particular, silicon and its compounds for MEMS.
- To be able to explain the basic and relevant design principles of MEMS and micro systems.
- To learn the scaling laws for miniaturization.
- To be able to identify the optimal micro fabrication and packaging techniques for micro devices and systems.
- To be able to handle mechanical systems engineering design of micro scale devices.
- To learn the fundamentals of nanotechnology.

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(17D87206) PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS

ELECTIVE – IV

UNIT I:

MANUFACTURING SYSTEMS & CONTROL:

Automated Manufacturing Systems – Modeling – Role of performance modeling – simulation models-Analytical models.Product cycle – Manufacturing automation – Economics 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 stochastics processes – Poisson process - Discrete time Markov chain models – Definition and notation – Sojourn times in states – Examples of DTMCs 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 state 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 Petri Nets – Definitions – Transition firing and reachability – Representational power – properties

– Manufacturing models.

Stochastic Petri Nets – Exponential timed Petri Nets – Generalized Stochastic Petri Nets – modeling of KANBAN systems – Manufacturing models.

REFERENCES:

1. Performance Modelling of Automated Manufacturing Systems/ Viswanadham, N and Narahari, Y/ Prentice Hall of India, New Delhi, 1994
2. Probability and Statistics with Reliability, Queuing and Computer Science Applications/ Trivedi, K.S./ Prentice Hall, New Jersey, 1982.
3. Fundamentals of Mathematical Statistics/ Gupta S.C. &Kapoor V.K./ 3rd Edition, Delhi, 1988

Course Outcome:

1. Students are expected to learnhow to formulate and solve computationalproblems analysis in the flow of fluids.

2. Familiar with the differential equations for flow phenomena and numerical methods for their solutions.

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(17D11204) COMPUTATIONAL FLUID DYNAMICS

ELECTIVE – IV

Course Objective:

1. To understand the mathematics, numerical analysis, statistics, and computer information science.
2. FLUENT application of engineering technology tools, and resources.

UNIT - I

INTRODUCTION: Finite difference method, finite volume method, finite element method, governingequations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactivesolution 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, multi step 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: Formulations of incompressible viscousflows by finite difference methods, pressure correction methods, vortex methods.

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

UNIT - IV

FINITE VOLUME METHOD: Finite volume method via finite difference method, formulations for two andthree-dimensional problems.

UNIT - V

STANDARD VARIATIONAL METHODS: Linear fluid flow problems, steady state problems, Transient problems.

REFERENCES:

1. Computational fluid dynamics/ T. J.C'hung/ Cambridge University press,2002.

2. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
3. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hemashava Publishers corporation&McGraw Hill.
4. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
5. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ McGraw Hill.
6. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
7. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford University Press/2nd Edition

Course Outcome:

1. Students are expected to learn how to formulate and solve computational problemare using in flow of fluids.
2. 2. Familiar with the differential equationsfor flow phenomena and numerical methods for that solution.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Tech – I year II Sem. (AMS)

L	T	P	C
4	0	0	4

(17D87206) INTELLIGENT MANUFACTURING SYSTEMS

ELECTIVE – IV

Course Objective:

- To understand the importance of intelligence in manufacturing systems, so as to apply the artificial intelligence in the application of manufacturing.

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, OSIModel, 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 approaches in KBSES, Structure of theKRSES.

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.

REFERENCES:

1. Intelligent Manufacturing Systems/ Andrew Kusiak/Prentice Hall.

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

Course Outcome:

- Students will get knowledge on Computer Integrated Manufacturing Systems and Manufacturing Communication Systems

- Students will be able to learn the Components of Knowledge Based Systems, Machine Learning and Knowledge Based System for Equipment Selection.

- Students will be able to understand and solve the group technology problems by using knowledge based system.

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M. Tech – I year II Sem. (AMS)

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(17D11211) MANUFACTURING SIMULATION LABORATORY

Course Objective:

1. Use full scale software such as 1,2,3,4,5, etc,.
2. Exploration of C-language and interlinking different packages.
3. Learning the different modeling techniques.

The students will be given training on the use and application of the following software to manufacturing problems:

1. Auto MOD Software.
2. PROMOD
3. SLAM-II
4. CAFIMS
5. Flexsim

They also learn how to write sub routines in C-language and interlinking with the above packages. Problems for modeling and simulation experiments:

1. AGV planning
2. ASRS simulation and performance evaluation
3. Machines, AGVs and AS/RS integrated problems
4. JIT system
5. Kanban flow
6. Material handling systems
7. M.R.P. Problems
8. Shop floor scheduling etc.

Course Outcome:

1. Understand the concepts of modeling of different manufacturing systems.

2. Integration of different software packages.

3. Develop knowledge about the simulators of manufacturing systems.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (AMS)

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(17D20301) RESEARCH METHODOLOGY

(Elective V-OPEN ELECTIVE)

UNIT I

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

UNIT II

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design.

Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.

Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis.

UNIT V

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text Books:

1. Research Methodology:Methods And Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.
2. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
3. Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.

REFERENCES:

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)

2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (AMS)

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(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS

(Elective V-OPEN ELECTIVE)

Unit I:

HUMAN VALUES:Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

Unit II:

ENGINEERING ETHICS: Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV:

ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V:

GLOBAL ISSUES: Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of

Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

Text Books :

1. “Engineering Ethics includes Human Values” by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.

2. “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

3. “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.

4. “Professional Ethics and Morals” by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.

5. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

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M.Tech III semester (AMS)

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(17D20303) INTELLECTUAL PROPERTY RIGHTS

(Elective V-OPEN ELECTIVE)

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learing.

2. Intellectual Property Right – Nleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,